

HOTELS ON THE WING

POPULAR MECHANICS

MAGAZINE



WRITTEN SO YOU CAN UNDERSTAND IT

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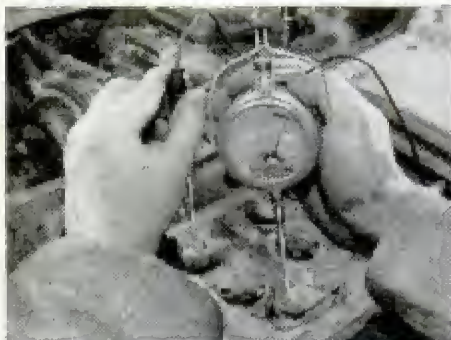


SEE PAGE 398

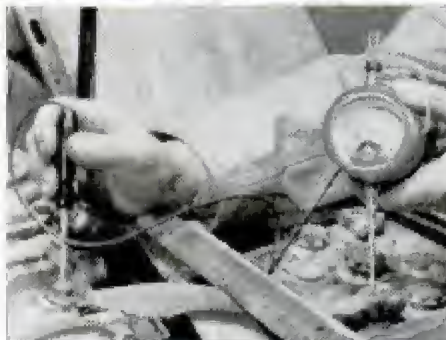
RACING THE MIGHTY MIDGETS



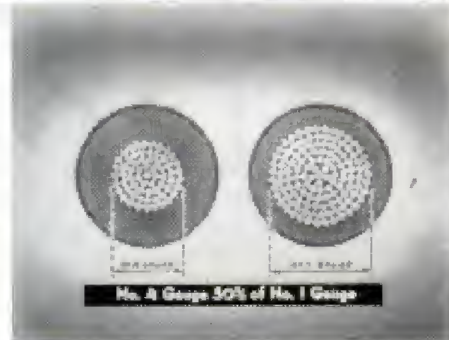
DO YOU KNOW



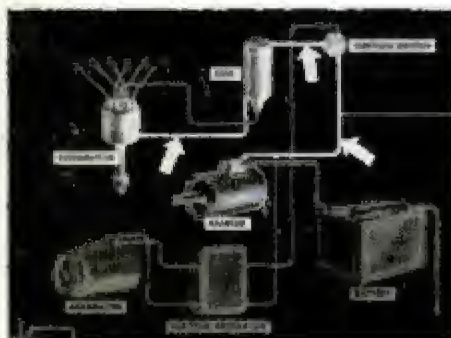
THAT a hydrometer reading of a battery is not the real indication of the battery's condition? This reveals only the chemical condition. To find the power available, it is necessary to check the battery under load with a low-reading voltmeter.



THAT voltage loss—caused by excessive resistance in cables, connections, or parts—may make the difference between a car that *will* start and a car that won't start? Battery cables and ground straps must be full size and free from corrosion.



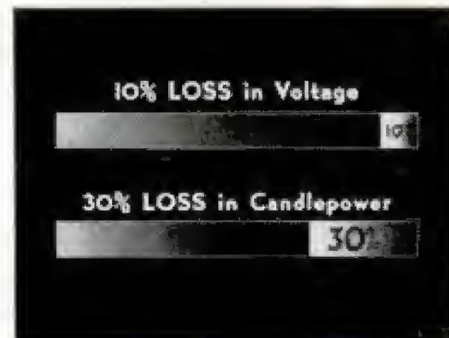
THAT some battery cables have only 50% as much copper in the core as the standard No. 1 gauge cable—and, therefore, have only 50% of the current-carrying capacity? All Packard battery cables are No. 1 or No. 0 gauge.



THAT a common cause of voltage loss and unsatisfactory performance in the primary ignition circuit is excessive resistance in the cables? New cables that are too small will not remedy this condition—they must be of proper size.



THAT cracked and oil-soaked insulation of the spark plug wires allows electricity to leak away and rob your car of pep, power and economy? Packard 440 ignition cable has a secret-formula protective sheath that seals in the high voltage.



THAT a 10% loss in voltage in the lighting circuit causes a 30% loss in candlepower? Because of this—and because old, worn or undersized cables are a dangerous fire hazard—good wiring is a very important safety factor.

AND DO YOU KNOW THAT—?

Packard Electric is the only cable company that trains mechanics with a program of Service Films and Service Instruction Manuals on Re-Wiring. This means that when you drive into a service station or garage where Packard cable is used, you are sure of getting the highest quality cable,

installed by mechanics who know how. Packard Electric Division, General Motors Corporation, Warren, Ohio.

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6. Big Safety-Steel Body.
7. Time-Proven, Double-Action Hydraulic Brakes.
8. Functional Design—new trend in styling gives Plymouth glamorous new beauty.
9. All Plymouth models have the same big, 82-horsepower "L-head" engine, giving full power and economy.



ALL PLYMOUTH MODELS—both "Roadking" and "De Luxe"—have a Safety-Steel body which is completely rust-proofed.

STANDARD EQUIPMENT on "De Luxe" models at no extra cost—Perfected Remote Control Gear Shifting with All-Silent Auto-Mesh Transmission. Marvelous new shifting ease. Nothing new to learn!



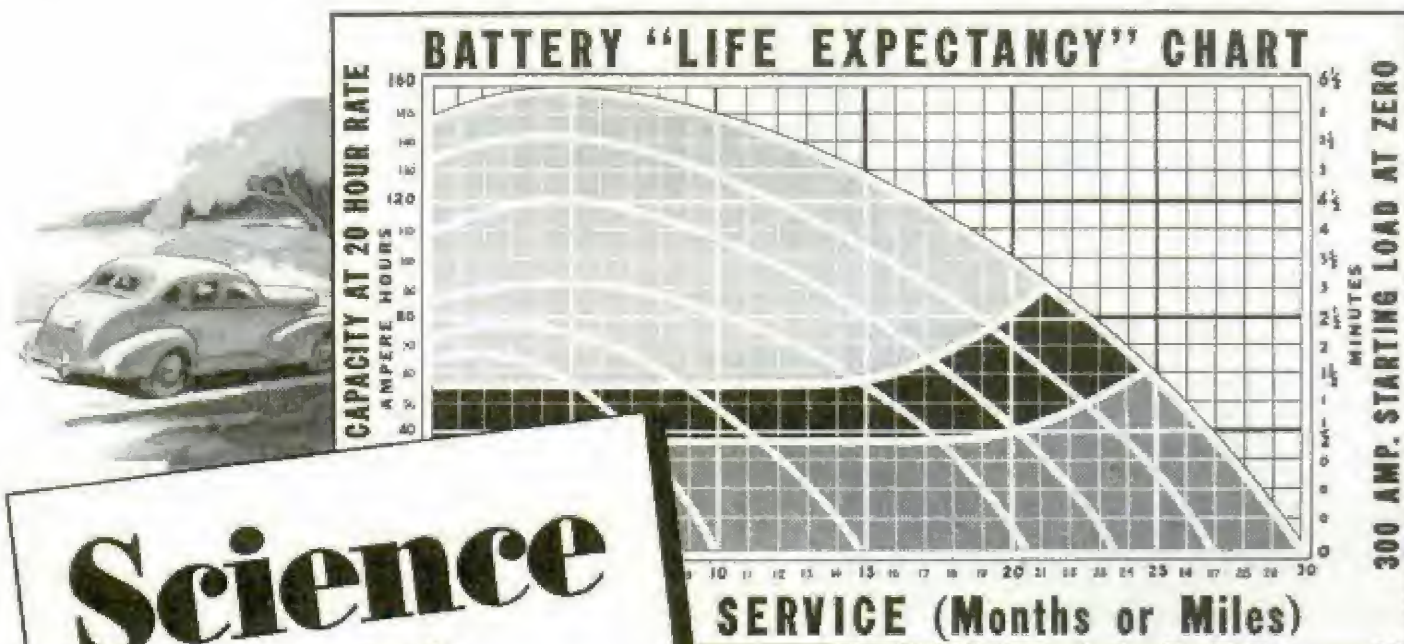
INCLUDED IN LOW PRICES:

"Detroit delivered prices" include front and rear bumpers, bumper guards, spare wheel, tire and tube, foot control for headlight beam with indicator on instrument panel, ash-tray in front and rear, sun visor, safety glass and big trunk space (19.5 cubic feet). Plymouth "Roadking" models start at \$645; "De Luxe" models slightly higher. Prices include all federal taxes. Transportation and state, local taxes, if any, not included. See your Plymouth dealer for local delivered prices. PLYMOUTH DIVISION OF CHRYSLER CORPORATION, Detroit, Michigan. TUNE IN MAJOR BOWEN'S AMATEUR HOUR, C. B. S. NETWORK, THURS., 9-10 P. M., E. S. T.

PLYMOUTH BUILDS GREAT CARS

NEW "ROADKING"
NEW "DE LUXE"





Science
comes
to the rescue

Now You Don't Have to Guess When Your Automobile Battery Is Likely to Give Out—You Can Know Beforehand When to Replace

When to replace a battery? This has always been a major problem for car owners. Naturally, every driver hates to risk the inconvenience and annoyance of having a battery go dead, particularly since this seems to happen when time is short or help is hard to get. On the other hand, nobody wants to turn in a battery that still has plenty of life in it.

Now science provides the answer! Delco-Remy—manufacturer of Delco Batteries—conducted an intensive research program. Complete information was collected on the service given by thousands of batteries. This data was classified and grouped to establish the original Ampere Hour Capacity of each battery and to show the Units of service which each had given (in passenger car service a Unit equals one month, or 1000 miles).

These figures were then tabulated and plotted into curves, to form the Battery "Life Expectancy" Chart.

To determine the probable life of any battery, measured in terms of its ability to crank an engine at 0° F., all that is necessary is to know the original Ampere Hour Capacity of the battery. Find the curve of the particular battery on the chart and follow it until it is intersected by the line indicating the Units of service which the battery has given. That point shows the probable amount of life left in the battery, and when it should be replaced.

Stop in at your Delco Battery dealer's and let him demonstrate how the "Life Expectancy" Chart works. He will also supply you with a smaller copy of this chart if you are interested—just ask him for it.

Delco Batteries are known the world over for long, dependable, efficient service. That is why they are standard equipment on all General Motors cars and trucks. Make your next battery a Delco.



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March, 1939

Vol. 71, No. 3

Special Features

The City of Tomorrow	321
Trapping Modern Cattle Rustlers	328
Miracle of New Color Movies	Coloroto
Paul Reveres of '39	348
"Hot Papa" to the Rescue	354
Grooming the Iron Horse	360
Air Line under Glass	367
Going Nature One Better	371
Hunting Lost Voices	377
Racing the Mighty Midgets	386
Making the Grade on Skis	392
Hotels on the Wing	402
Topsy-Turvy Weather Magicians	410

(Continued on next page)

Guarding Your Gold

RUMOR has it that Britain's gold lies hidden in a secret vault beneath the Thames river, that France stores her monetary wealth under the Seine where no invading army could discover it. But Uncle Sam, hoarding the greatest treasure in all time—twelve billion dollars in gold alone and a mountain of silver besides—frankly tells you just where to find it and what obstacles face any desperate band that would risk death to crack the national safe. At Fort Knox, Ky., lies one-fourth the world's monetary gold supply, safer behind its iron fence, moat and drawbridge than a medieval castle; its ten-foot concrete base rests on solid rock, defying even an earthquake; its roof is bombproof, its steel beams "breathe" deadly gas at the touch of a blowtorch. Read in the April issue how Uncle Sam guards your staggering pile of riches.

Next Month

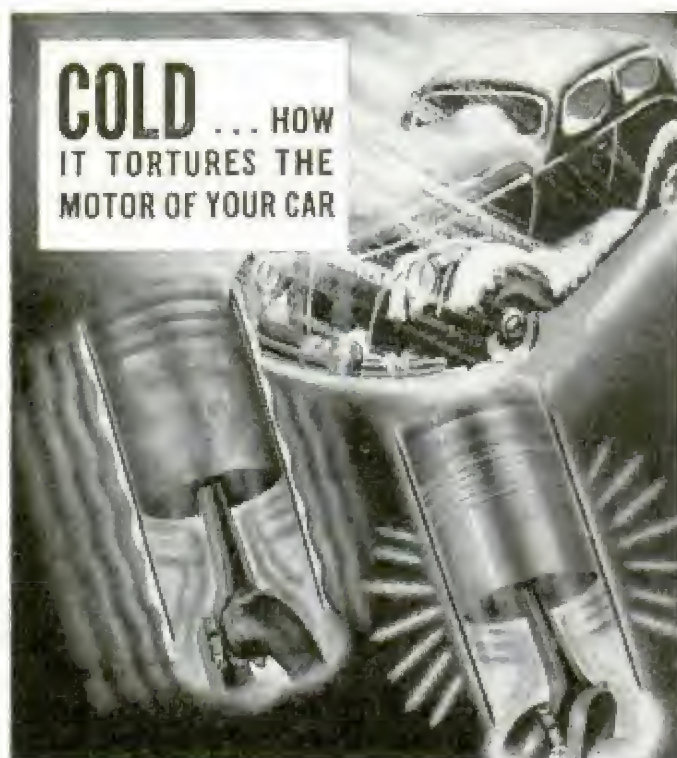
ONE of the most hazardous occupations in the world is that of the Ruhe family, who for seventy years have been combing the jungles and deserts and mountains around the globe for wild animals and birds. If you want an okapi or a black swan or an African bongo they'll get it for you, although it may involve trouble with native tribes and a lot of nursing for seasick animals. An article next month tells of the adventurous business of the Ruhe brothers.

Heroes on the Air

TUNE in on the radio news bulletin and you may be listening to a hero—for it takes heroics to cover mine disaster and hurricane, shipwreck and war. One radio reporter carries the microphone within sound of bursting shells at Barcelona, another brings you the sound of Vesuvius' boiling lava. Read the adventures of radio heroes in the April number.

Army Color "Spies"

CAMOUFLAGE that tricks the human eye cannot fool the color camera that sees through haze and shadow. Army cameramen have flown above New York City and snapped pictures revealing the color of taxicabs in the street "canyons" far below. How natural color photography is changing the game of war is told next month, illustrated with eight pages of Coloroto.



**COLD ... HOW
IT TORTURES THE
MOTOR OF YOUR CAR**

When you start your car in cold weather, pistons like this race INSTANTLY up and down, 1300 times per minute. Twenty-two times per second! Sluggish, half frozen oil, drained to the base, won't go to work that fast. Thirteen hundred blistering, scraping, metal wracking strokes take place without benefit of lubrication. Here is a main reason why your motor wears out. This is what depreciates your investment.

This piston, bearing and shaft are bathed in Pyroil. A protective lubricating film is provided that always stays on the metal in spite of heat or cold. The Pyroil film does not drain into the base. Pyroil is different from regular lubricating oil. It lubricates from the moment these parts go into action. There is no metal to metal clash and damage. No fierce, metal wearing friction. Battery drain is diminished. Your motor starts easier. Oil and fuel consumption are lessened. Here is what protects your motor and saves you money.

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(Contents—Continued)

AUTOMOTIVE

Street barriers help control traffic	333
X-ray exposes tire weaknesses to car owner	336
Optical tester for headlights	359
Cars passing at fifty require 1,000 feet	364
Brake gauge "tailors" drum and shoe to size	368
Overshoes built into tire treads	368
Illuminated sign is turned by wind power	369
Steel hook for straightening auto fenders	374
Auto brake power booster	380
Ambulance air conditioner	385
Driver re-enacts crash on chart at "trial"	385
Rubber-covered bumper pushes without marring	389
Parabolic barriers add to highway safety	390
Bike wheel attached to bus measures acceleration	400

AVIATION

Radio "ear" for blind flying	358
Target planes salvaged when hit by gunfire	365
Autogiro tested for military observation	384
Fabric fuel tank withstands vibration	384
Pilot sits in tail of fighting plane	415

CONSTRUCTION

Jack-in-the-box platform for workmen	370
Two-mile traffic tunnel links river cities	389
Air circulator in fireplace gives more heat	407

Windmill FARM sails 382	
Self-closing bumper gate for automobiles	374
Twin-propeller windmill built by farmer	384
Plants raised under artificial light	390
Plants "analyze" their own soil	400

HOUSEHOLD

Self-starting siphon lifts heavy liquids	332
Electric shaver carries a headlight	358
Pedal converts bathinette into dressing table	416
Register fan circulates heat from furnace	120A

PHOTOGRAPHY

Supersensitive exposure meter	336
Soft metal frame binds film for projection	353
Automatic home movie titler saves time	364
Camera trick shows windmill arching in "wind"	368
High-speed photo of perfect golf drive	383
Pictures centered for mounting by three-way ruler	385
"Fishing pole" lifts camera for odd angles	406
Filter for camera lens provides five changes	407
Automatic darkroom timer works like dial phone	416

RADIO AND ELECTRICITY

Facsimile newspaper printed on home radio	333
Refrigerator used as oven for heat tests	364
Torpedo antenna for television	369
Electric fence stops "ticks" carried by deer	374
Four-in-one automatic fuse	414
Set automatically tunes in your favorite programs	417
How to build portable phono-radio	418
Five-band preselector for short-wave receiver	420
Practical radio hints	421
All-purpose mobile sound system	422
Line noise analyzer saves time	422
Portable set is self-powered	422

SCIENCE AND INDUSTRY

Fireproof eyeshield covers entire face	332
Fume detector sees shadow cast by vapor	353
Earth's death in fire visioned	376
Anesthetic kills pain for three weeks	380
Oil under pressure runs engine	390
Doctors "pipe" cold light through curved rods	391
Transparent film of rubber non-inflammable	401
Quick-frozen food in sealed cans	408
Electrons measure wear of metals	416

SPORTS

Bowling and golf combine into new game	358
Golf club penalizes incorrect swing	376
Foot-and-hand cycle has streamline hood	390
Outdoor ice rink enjoyed all summer	408
Automatic timer for swimmers	409
Bicyclist tours with trailer carrying his bed	409
Starter's gun holds fire if runner lifts hand	414

(Continued to page 6A)

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(Contents—Continued)

TOOLS

Two-hundred-pound wrench turns hinge nut.....	358
Power-driven saw cuts trees into logs.....	391
Lathe with power cross feed.....	408
Electric knife grinder in streamline case.....	414

MISCELLANEOUS

Rubber exhaust for motorboats is non-corrosive.....	332
Snowplow made from powered lawnmower.....	332
Barrow inside giant wheel carries big loads.....	359
Clamps for carpenter's horse holds without nailing.....	359
Lead foil in shoe aids X-ray fitting.....	364
Insulation sprayed on wall like paint.....	365
Electric lunch box heats meal for worker.....	370
Foot and hand powered tricycle.....	370
Ribbed hot-water bottle fits around arm.....	374
Old ships converted into fast ocean liners.....	375
Plastic splint easily shaped to fit arm.....	376
Permanent ink for writing on glass.....	380
Refrigerated locker under floor lifts out.....	380
Water-color mural air view of New York.....	381
Miniature village completes night and day cycle.....	383
Freak accidents spare some, kill others.....	396
Highway snowplow shovels and loads.....	396
Motorcycle daredevil smashes through barrels.....	396
Thousands of models in builder's collection.....	397
Magnetic rocks hooked like fish.....	400
Translucent plastic statues lighted inside.....	401
Allergy sufferers are smarter in tests.....	406
Motor-driven tutor teaches body swim strokes.....	407
Tandem bicycle float.....	416

(Craftsman and Shop Notes)

AUTOMOTIVE

Vacation shaving from a car battery.....	451
Helps for the motorist.....	477
Chalk locates cracks in axle.....	478
Flexible driveway markers.....	478
Improving toe accelerator.....	478
Pipe stakes on truck.....	478
Suspended skid chains move truck on inclines.....	478
Cleaner for battery posts.....	479
Duplicate patch balances inner tube.....	479
Flashlight to inspect batteries.....	479
Grease gun operated by carpenter's brace.....	479
Excessive tightening weakens connecting-rod bolts.....	480
Rollers on truck driver's skid.....	480

CHEMICAL AND CHEMISTRY

Crystals crushed with razor.....	432
Pneumatic trough and "beehive" for home chemists.....	438
Sand bath for chemists.....	448
Bottle stoppers from erasers.....	454
Pestle from doorknobs.....	475

FARM

Anchoring ends of woodpile.....	432
Gate latch from hinge.....	432
Draftless ventilation in dairy barns.....	462
Double slide in grain spout measures feed.....	472

FURNITURE

Pioneer footstool in maple.....	428
Re-caning saves old chair.....	434
Portable study desk.....	441
Sewing box has pivoted trays.....	455

HAND TOOLS

Clinching nails aided with file.....	432
Clamp to hold work while scrollsawing.....	439
Rack over bench has flexible pockets.....	448
Screw holder quickly bent from wire.....	443
Simple mandrel to wind springs.....	450
Using expansion bit in hardwood.....	455
Altering drills for sheet metal.....	466
Soap lubricant on metal punch.....	476

HOME WORKSHOP

Loosening tip of soldering iron.....	432
What you can do with two wheels.....	437
Anchoring hammer heads.....	476

(Continued to page 8A)

1937

1938

1939

1940

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portunities flourish for *every* American every day of his life.

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3-IN-ONE OIL

(Contents—Continued)

HOUSEHOLD

New frames for your pictures	423
Neat pipe supports for clothesline	426
Folding tie racks and shelves	439
Solving home problems	456

LAWN AND GARDEN

Protecting seedlings in hotbeds and cold frames....	426
Slatted hotbed covers protect plants	438
Lawn roller from expansion tank.....	450

OFFICE

Replacing rubber typewriter feet	450
Applying drawing ink to pen	466
Drawing board held at angle with casement adjuster.....	475

PHOTOGRAPHY

Periscope for taking photos in crowd	425
Homemade dispenser measures ferrotyping polish.....	426
Pocket viewer for film.....	438
Signs produced by photography	448
Negative dryer has warm-air circulation	463
Lamp lights on plateholder depth gauge.....	465

POWER TOOLS

Changing jig-saw blades with block of wood.....	427
Tenon jig for circular saw	433
Protecting threads on chucked work	438
Saw miter gauge has auxiliary straightedge.....	455
Correct centering on lathe	459
Testing drill-press table for precision work	466
Tool post holds emery cloth for polishing.....	471

STORE AND SHOP

Shoe-shining kit slides under chair seat	453
Handle for stamp pad	462
Outdoor display stands on casters	462
Papers on scale safe in wind	462
Silent signal for waiters	464
Two-wheel trucks move heavy loads	464
Window panes protected by wire mesh	464
Shop-broom holder from hose	471
Springs grip wrapping paper	471
Linotype slugs held in galley by eraser	472
Cleaning rusted overhead shafts	476

MISCELLANEOUS

Cleaning empty paint pails	425
Small parts storage cans identified quickly.....	426
Foot bridge from car frames	427
Guides aid in manifold work on typewriter.....	427
Non-slip surfaces for ladder rungs	430
Shield keeps sleet from flag-pole pulley	430
Smoothing inside wood rings on belt sander.....	430
Turned "bird valet" holds pipe and cleaners.....	430
Design for time	431
Streamlined sidewalk scooter	433
Avoiding cracks in tops of hip boots	439
"Skipper"—low-cost outboard runabout	440
Locating leaks in wading boots	448
Ruled celluloid aids in making sketches.....	449
Building paper applied with scaffold in place.....	450
Pencil clip improvised from paper clip	450
Completing interrupted card deal	452
Rotating drawers save space	453
Celluloid shield under paper fasteners	454
Fire kindled with brick soaked in kerosene.....	454
Leg anvil from flatiron	454
"Tailored" tennis rackets	454
Auto casings protect children on seesaw	458
Fancy washers on bolt heads	458
Chalk substituted for showcard brush	464
Design transferred to linoleum block with ammonia.....	465
Novelty finishes with brush and spray	467
Handles for carrying lengths of pipe	472
Tamper-proof air vent on gas tank	472
Cementing glass, metal and celluloid	473
Installing fuel tank on light plant	476

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It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.



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| <input type="checkbox"/> Reading Shop Blueprints | <input type="checkbox"/> Auto Technician | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Fruit Growing |
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BUSINESS TRAINING COURSES

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Service Station Salesmanship | <input type="checkbox"/> Grade School Subjects |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Secretarial Work | <input type="checkbox"/> First Year College Subjects | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Spanish | <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> College Preparatory |
| <input type="checkbox"/> Accountancy | <input type="checkbox"/> French | <input type="checkbox"/> Stenography and Typing | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> Cost Accountant | <input type="checkbox"/> Salesmanship | <input type="checkbox"/> Civil Service <input type="checkbox"/> Mail Carrier | <input type="checkbox"/> Cartooning |
| <input type="checkbox"/> C. P. Accountant | <input type="checkbox"/> Advertising | <input type="checkbox"/> Railway Mail Clerk | <input type="checkbox"/> Lettering Show Cards <input type="checkbox"/> Signs |

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- | | | |
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| <input type="checkbox"/> Professional Dressmaking and Designing | | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |

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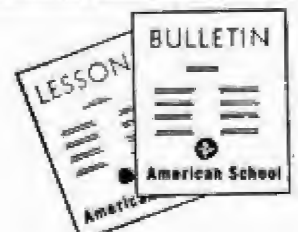
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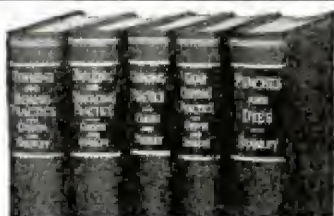
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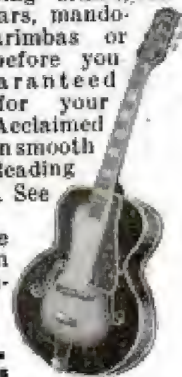
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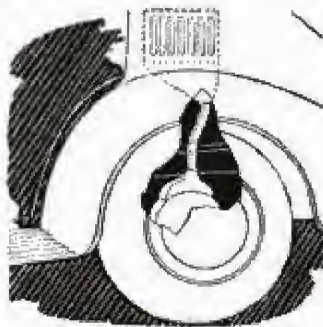
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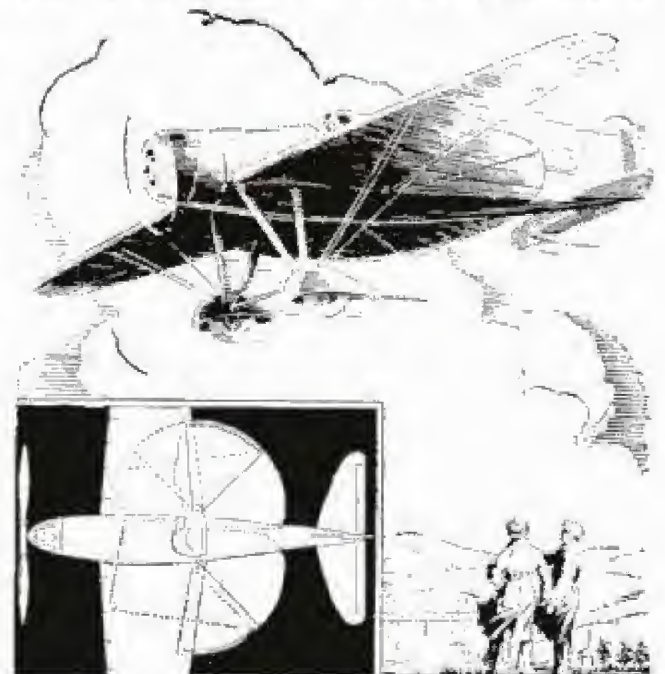
A SUBSTITUTE for the chain-drive method of bicycle propulsion has been patented. It consists of a pedal on each side connected to the rear hub through gears. The rear hub has two reciprocating clutches through which the gears are connected to

the hub. The pedals are caused to rise alternately through the use of two ball-and-socket jointed links connected to a small lever on the underside of the bicycle frame. The revolving pedals of the conventional drive are replaced in this system by pedals of long leverage which oscillate through only a fraction of their circumference, thus making it possible to utilize most of the force applied. In the conventional drive, there is only about fifty per cent efficiency, since about one-half the force applied to the pedal goes to the hub



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could be moved out of the open rear edge to form a sector-shaped wing extending from the fixed wing in a semicircle to the rear of the fuselage. Controls within the pilot's compartment would be used for manipulating the auxiliary wing. One advantage of such a wing would be that the plane might land at slower speed.

(Continued to page 33A)

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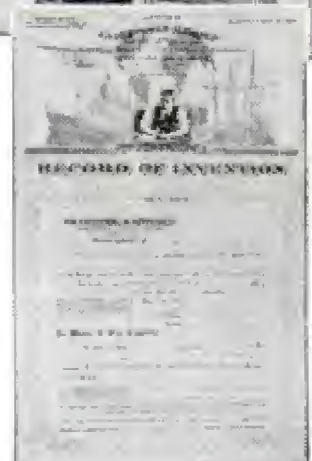
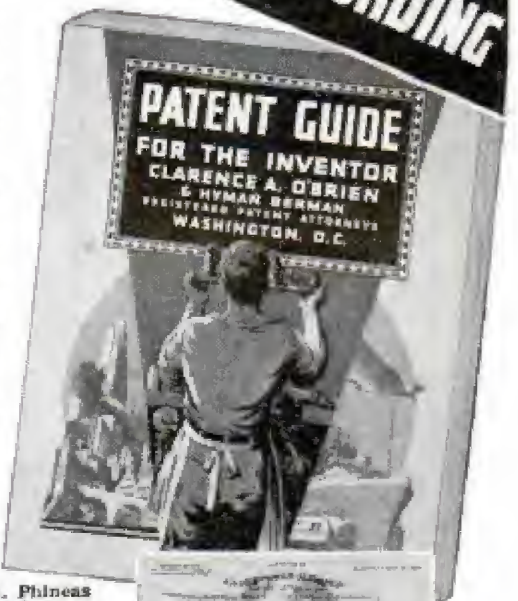
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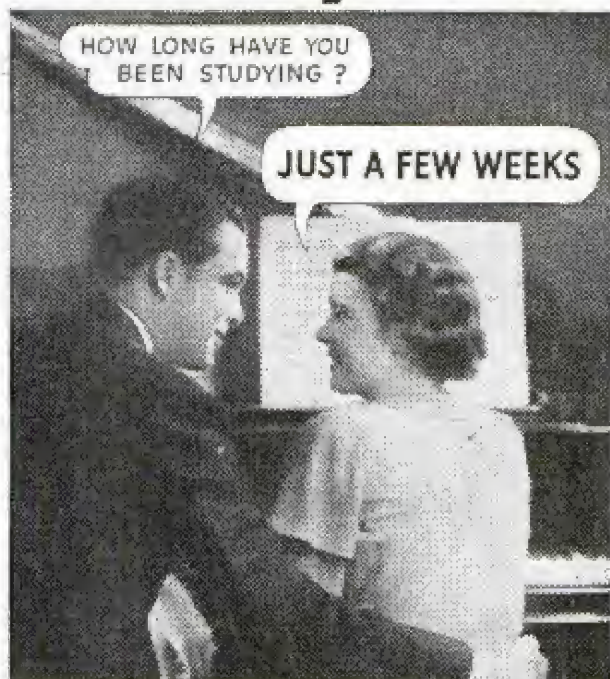
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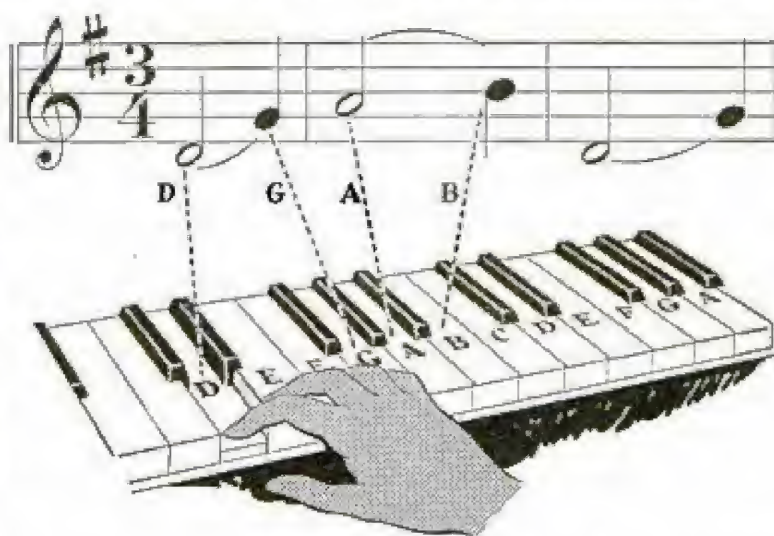


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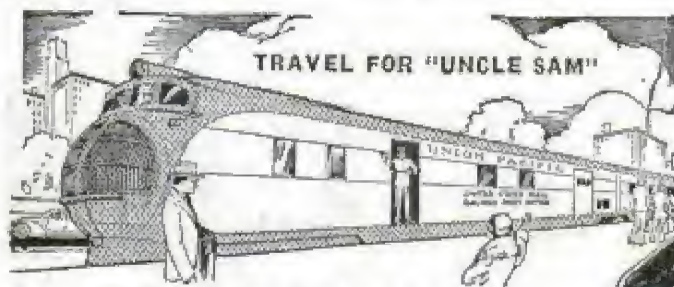
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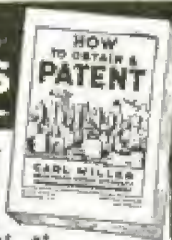
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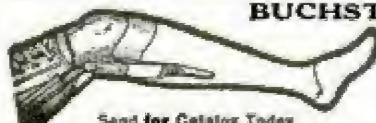
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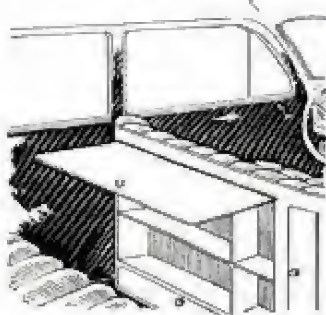
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(Continued from page 20A)

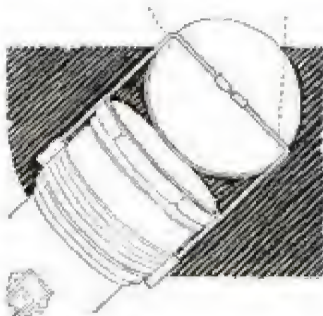
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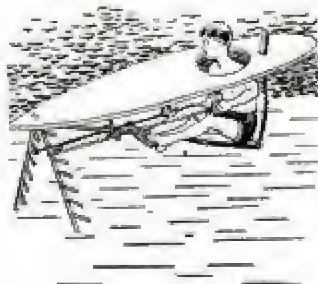
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(Continued to page 54A)

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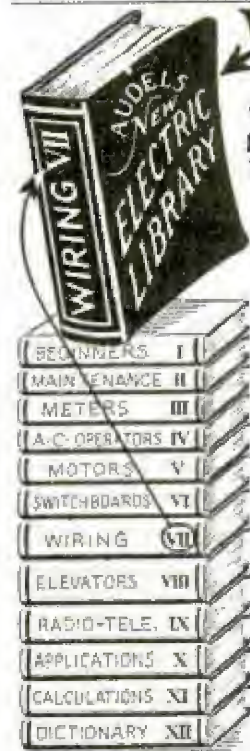
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\$50 WEEK With a kodak. Booklet describes 100 magazine markets 35c. S. George, 285 East Queen, Philadelphia, Penna.

MAKE Money selling snapshots. Dime brings 152-page book complete instructions, markets, real information. Lyons-Publishers, 3016-P Elgin Avenue, Baltimore, Md.

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PERSONAL Exposure record gummed labels. Your name imprinted. Attach to back of your photographs. Contains space for writing complete data about each photo. 500 labels, \$1.00, postpaid. Herald, Batavia, Illinois.

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FREE Lists, 16mm., 8mm. films, cameras, projectors, accessories. Home Movies, Box 216, Easton, Pennsylvania.

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TALKIES. Silents, 35mm., sale, rent, UFD, 15903 St. Mary's, Detroit, Michigan.

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TALKIE \$15.00, Silents \$5.00. Projectors. Simpson, 1275 South Broadway, Dayton, Ohio.

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35MM. SILENT. Rented 50c weekly. Calderara, 5119 South St. Louis, Chicago.

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8mm., 16mm. FILMS. Cameras, projectors. Bargain list. Block, 1265 Broadway, New York.

PROJECTOR Film; sample, 10c; lists free. Goodwill Company, Jackson, Tenn.

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MOVIE Film. Develop yourself. Univex, Eastman, etc. Chemical samples 15c. Raw film wholesale. Lake Camera Exchange, Gary, Ind.

LEARN Motion picture theatre management, advertising, projection. Free catalog. Give age. Theatre Institute, Elmira, N. Y.

16-35MM. RENTED 50c Weekly; lists 3c. Hoffman Film Service, 57 Broad, Albany, N. Y.

BARGAINS! 8mm., 16mm., free literature. Elder, B-739 Boylston, Boston, Mass.

RELIGIOUS Pictures for rent or sale, 16mm. and 35mm. sound or silent. All-Sacred Film Co., 31 Melrose St., Boston, Mass.

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SONGWRITERS! Musicians! Singers! Teachers! Music Arranger, 6574 Gundry, Long Beach, California.

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SONGS. Poems, bought, composed, arranged, published. Royalty contract, free information. Metro-Melody Publishers, 532A Geary, San Francisco.

ORIGINAL Poems, songs wanted for publication, radio. Westmore Music Corporation, Dept. 33H, Portland, Ore.

SONGWRITERS: Free! Valuable booklet. Interesting, instructive. Len Fleming, Wellsboro, Penna.

VIOLINS—Handmade masterpieces, best since Stradivarius, John Lehto, San Pedro, Calif.

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SONGPOEMS, Melodies. Outstanding offer. Hibbeler, C-5, 2157 No. Avers, Chicago.

SEND \$1.00 To Piano Shorthand Music Company, Springfield, Illinois, for How to Play Piano by Ear.

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DANCE Orchestrations popular back numbers, 10—\$1.00. Silverman, 3305 Lawrence, Chicago.

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SONGWRITERS! Send poems. Best price, service available. Variety Service, Salem, Indiana.

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MUSIC Composed to words. Wonderful proposition. Bauer Bros., Oshkosh, Wis.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub. Co., 201 N. Hoyle Ave., Chicago.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

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MONEY! Money! Yes you can make money. Ten special money-making formulas for one dollar. Reeve, Box 3012, Knoxville, Tenn.

MARVELOUS Beauty plan 25c. Edcoes Service, 39 Pine, Brooklyn, N. Y.

MILLIONS Jobs! Supply satisfying employment information by mail. Keep dollars received! We fill your orders. Details, stamp. Co-Operative Service, 77 Swan, Buffalo, New York.

START Profitable, permanent business, making distinctive, raised-letter stationery; home, spare time. Sells quickly to homes, offices. New, simple, amazing process; no experience or printing equipment required. Get sample sheet, information quick! Home Embossers, 1071 Niagara, Buffalo, New York.

MONEY In butterflies, moths. See Sinclair Display Advertisement on page 24A.

\$25.00 STAMPING Names per 100 key-checks. Sample 25c. Details furnished. Bohn Company, Box 86P, Wilkes Barre, Penna.

"OPPORTUNITIES Everywhere for Everybody." Best offer on market. Particulars free. International Research Bureau, 1115 Sherman, Denver, Colorado.

TYPISTS Earn extra money. Quarter brings "Twenty-One Way to Make Money With the Typewriter." H. Robbins, Box 6048, Kansas City, Missouri.

EARN Extra money writing for publication. Simple method. Demand inexhaustible. Details free. Dona Veretts, 17 Gorton, Lowell, Mass.

MONEY Makers for ambitious people—a 32-page "gold mine." Stamp brings everything. Lone Star Service, Box 772, Dallas, Texas.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, OS-1142 Sunnyside, Chicago.

MONEY From honey. Good, steady income from small investment. Information how you can determine whether you can put bees to work making money for you. Send 25c. Box 385, Boston, Mass.

INCREASE Earnings. Information quarter. Service Sales, Box 115, Cleveland, Tenn.

MOULDS. Guaranteed, for casting toy soldiers, Indians, trappers, warships, sinker moulds, 244 kinds. Send 5c for illustrated catalogue. Henry C. Schlercke, 645 Spencer, Ghent, N. Y.

WHERE To buy exceptional articles at lowest wholesale. Information free. Stamford, 3762-C Broadway, New York.

BIG Money easily made; 107 test plans for your choice. Home, office. Descriptive booklet free. Elite Co., 214 Grand St., New York.

FREE Folio describes 2000 ways to make money. Marvin Studios, 203 South Dearborn, Chicago.

GROW Plants without soil. Folder free. Gordon Laboratories, 509-H Fifth Ave., New York.

UP To \$60 weekly! Spare or full time. Capital and experience unnecessary. Your own advertising service. Something new. Your services always in big demand by everyone in business. Complete working plans, \$1.00. No other investment. Universal, Box 1461, San Antonio, Texas.

YOUR Name—5,000 mailing lists—25c. Get samples, opportunities galore from all over world. Pines, 583-A Monroe, Brooklyn, N. Y.

MAILORDER Opportunities, plans, formulas, information. Circulars free. Harvey Teeple, Decatur, Indiana.

STOP Squealing—Start crowing! Work mornings home—country drives or movies—afternoons! No canvassing! Folio-A, Station "D," Los Angeles.

MAN In each town to plate auto parts, reflectors, bicycles, fixtures, mirrors, by late method. Simple plan of manufacturing at home starts you in good paying business. Free particulars and proofs. Gunmetal Co., Ave. N. Decatur, Ill.

RAISE Earthworms for profit. Information free, stamp appreciated. Bureau Zoological Research, 100A Broadway, Peoria, Ill.

WHOLESALE Sources, 500,000 articles. Free directory. Maywoode, 925 Broadway, New York.

FORMULAS, PLANS, ETC.

PICTURE Transferring compound, grease paint, spot remover, disappearing ink, invisible ink. Instructions with 28 others, all for dollar bill. Rousseau, 415 6th St. N. W., Grand Rapids, Mich.

FOR Those desiring home employment. 25 moneymaking formulas \$2.00. Write Eugene J. Sousa, 61 Union St., Nantucket, Mass.

SELF Vulcanizing cement. 50c to Formula Agency, 490 Western Ave., Lynn, Mass. Typed formula.

GUARANTEED Formulas—New fast sellers. None better. Lowest prices. Catalog free. Kemico, 49M, Park Ridge, Ill.

REFINE Used oil without cost. Particulars. F. Gerwin, Fairview, Okla.

FORMULAS: 15 Proven moneymaking formulas \$1.00. (Not stock-formula catalogue stuff), real unusual offers. List free. Marvel Laboratories, 6629 No. Maplewood, Chicago.

FORMULAS—All kinds. Real money-makers. Lowest prices. Catalog free. Clover Formulary, P-3, Niles Center, Ill.

NEW Formulas. Analysis. Free literature. Research Development Laboratory, 449 So. Ionia, Grand Rapids, Mich.

MAKE More money! Manufacturing "Popular Branded Products." Stamp brings informative Formula Messenger telling how! Miller, Chemist, (Established 1897), 706-Mt. Tampa, Florida.

GROW Plants without soil. You can do it. Home apartment, cellar or outdoors. Remarkable growth year round. 25 gallons season supply chemicals, directions, bibliography, \$1.00 postpaid. Chemi-Culture, 4701-N Sheridan, Chicago.

FORMULAS 1c Each! Literature; sample formula 3c! Galluzzo, Wilkinsburg, Pennsylvania.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

FORMULAS Free. Where to get and three money making plans 25c. Box 116, Bluford, Ill.

NEW Confection, resembles potato chips. Easily made. May Lee, 1829 Kennett, St. Louis, Mo.

ELITE Formulas and plans; make and sell your own products. Descriptive booklet free. Elite Co., 214 Grand St., New York.

THAXLY Formulas for perfect products. Accurate analysis assured. Resultful research. Catalog free. B. Thaxly Co., Washington, D. C.

FORMULAS. Latest money makers. Literature free. Belfort, 4042 N. Keeler, Chicago.

CHEMISTRY

HANDBOOK For chemical experimenters. Illustrated, hundreds of experiments, postpaid 50c. Experiment booklet 15c. Catalogue, 5c. Reading Scientific Company, Reading, Penna.

GENERAL Chemistry simplified. 35c pamphlet. Joray, 2731 Vine, Cincinnati, Ohio.

CHEMICALS In 5c quantities. Catalog 5c. Fleischer's Laboratories, Everett, Mass.

CHEMICALS. Laboratory, glassware, apparatus. Send 3c for catalog CPI. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Send 3c for postage. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

TELESCOPES. Microscopes, chemistry, mineralogy. Scientific catalog free. Tracey Laboratories, Evanston, Illinois.

AGENTS WANTED

AGENTS—Fast selling, patented hair cutter, simple, easily used. Converts safety razors into hair cutters. Send 30c for sample and details. Universal Converter Company, 305A Dime Building, Allentown, Penna.

AMAZING Profits selling new lotionized cleaner. Something different. Whirlwind seller to housewives. Write immediately. Clean-O, 1323 Elm St., Denver, Colo.

PERMANENT Representative wanted for Hoover uniforms to call on restaurants, hotels, beauty parlors, doctors, nurses, others. Excellent immediate income. Leads furnished. Valuable equipment free. Hoover, Dept. BJ-B, 251 W. 19th, New York.

212% PROFIT Selling amazing new liquid mender. Fixes most anything; unlimited demand. Write for free sample proof, Indiana Laboratories, Dept. T-39, Elkhart, Ind.

BEAUTIFUL Bird pictures handmade with genuine feathers. Sell on sight! Large profits! Free particulars. Samples 10c stamps. Marquez-PH, Apartado 1176, Mexico City.

500% PROFIT With new perfected (1939) quick-action, no flint, automatic gas lighter. Retail 25c. Sample 5c. New Method Co., Box PMG-76, Bradford, Penna.

BUSINESS Proposition resilvering mirrors, autographs, reflectors, making chipped glass signs. Write, Sprinkle, Plater, 128, Marion, Indiana.

SELL Signs, mottoes. Write Schaffner, 1336 West Rush, Philadelphia, Penna.

WANTED—Purchasing agents, no experience or money required, write and mail 3c stamps for application to Purchasing Mgr., 176 N. Halsted St., Chicago.

WORLD'S Fastest money maker. Sell 50c packs of razor blades for 5c. Tharp, 914 Lexington, Cumberland, Md.

500% PROFIT! Gold and colored sign letters for windows, offices, trucks, signs. Auto monograms. Easily applied by agent or customer. Neonite, Akron, Ohio.

AGENTS Wanted. Fast selling smoker's novelty, ejector cigarette case. Write Campbell, 47 E. Ohio, Chicago.

UP TO \$6.00 an hour. Amazing Kar-Nu beautifies old cars with sparkling new finish—without rubbing, polishing, waxing, painting. Costs little. Wipes on with cloth. Lasts 8-12 months. Free sample. Kar-Nu, Dept. R-8, Cincinnati, Ohio.

MAN And wife—to run local coffee agency. Earnings up to \$240 in a month. New Ford sedan given you as bonus. I send complete outfit. You don't risk a penny. Details free. E. J. Mills, 3208 Monmouth, Cincinnati, Ohio.

MAGIC Clothes brush. Revolutionary invention. "Erases" dirt like magic. Saves drycleaning. Sensational seller. Samples sent on trial. Rush name. Kristee, 103, Akron, Ohio.

START Making money selling new exclusive flat pencils with note books for pocket and purse. Sample 50c guaranteed. Harris Products, Orange, Mass.

SELL Social security plates. Sample 10c. Particulars free. Reliable Sales Co., 8 West 28th Street, New York City.

BIG Money taking orders: shirts, ties, hosiery, underwear, pants, uniforms, dresses, etc. Sales equipment free! Experience unnecessary. Write Nimrod, 4922-AN Lincoln, Chicago.

AGENTS—Salesmen—District managers—New \$1.00 auto necessity. Every auto owner needs. Season on. Over 100% profit. Details free. Hylite Laboratories, PM-2007 Grand Ave., Chicago.

YOUR Own local shoe business. Free outfit starts you! Bonus shoes given. 173 styles. Big advance commissions. Experience unnecessary. Tanners Shoes, 953 Boston, Mass.

200% PROFIT. No investment, fast seller, field unlimited. Danna, Box 57, West New York, New Jersey.

TOOTH-BRUSH Cabinets. New, sanitary. Liberal commissions. Sample 50c. B & C Woodshop, 2812 Roosevelt Road, Chicago, Illinois.

INITIAL Automobiles. Big profits. Outfit \$2.00. Samples 3c stamp. Money-back guarantee. Evans Products, Midian Avenue, Windsor, Conn.

AMAZING. Speedy self-selling. "one-call" proposition; every day your pay day! New, sensational, money-saving 7-Purpose Beauty-Lotion Concentrate. \$24 profit possible from dollar investment! Write quick; territory going fast. Ermadon, 301 Emslie, Buffalo, New York.

GALVANIC Roofing paint. Dependable weather proofing guaranteed. Add 5, 20 years to roofing. Particulars. Agents. Galvanic Products Co., Vanderbilt, Penna.

\$1 STARTS You in business selling complete line ties. Slide-ons, bows and novelties. Over 100% profit. Write today for descriptive wholesale catalog, prices and free sample materials. Philip's Neckwear, 20 West 22nd, Dept. P-1, New York.

YOUR Name on the label and all repeat business must come to you. Cosmetics, toilet articles, food products, medicines, flavoring extracts, household specialties. 200% to 400% profit. Build a real business of your own. We print your name on the labels at no extra charge. Send ten cents for complete details and prices. National Scientific Co., Box 5269, Richmond, Va.

NECESSITIES Always in demand! Experience unnecessary to earn steady income selling shirts and sportswear factory to wearer. Gigantic variety; one year guarantee; customized fit (90 sizes). Half price offer creates amazing values. World's largest concern of its kind. Our sales force earns \$100,000.00 yearly. Get your share! Simply write orders. We deliver and collect. Postcard brings you complete money-making outfit free. Write Dept. 206, Rose-cliff-Quaker, 1239 Broadway, New York.

AGENTS. Sell all purpose cleaners to hotels, dairies, banks, taverns, hospitals, housewives. Distributors name on each box. Kleenwell Products, Box 1324, Youngstown, Ohio.

DON'T Be a job hunter—Start your own business on our capital. No hard times; no lay-offs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary. Wonderful opportunity to own pleasant, dignified, profitable business backed by world-wide industry. Write Rawleigh's, Dept. C-U-PPM, Freeport, Ill.

STA-WELD Permanently seals leaky radiators, cracked cylinder blocks, etc. Big repeating money maker. Factory, 2812 Gillham, Kansas City, Mo.

GRANITE Monuments. \$9.90 up. Delivered. Lethered. Catalog. Mikelich Company, St. Cloud, Minnesota.

MONEY in butterflies, moths. See Sinclair Display Advertisement on page 24A.

FRONT Money at once. Sells for 98c. Profit as much as 78%. New item. Sells like hotcakes. Territories going fast. Act quick! Details free. Ajax Tool & Die Co., Dept. 35, Racine, Wis.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

EX-O-LENE. New, red-hot, repeat auto product. Guaranteed. Millions waiting. To 500% profits. Information free. Thermo Exolene Works, Peoria, Ill.

AMAZING Zipper clothesline. Instant demonstration. Sells on sight. Dunn Mfg., Hempstead, N. Y.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order decalomania name plates. "Ralco," 1305 Washington, Boston, Mass.

ELGIN. Waltham, Hamilton watches. Make big money. \$3.95. Send for free jewelry catalog. Plymouth Jewelry Exchange, 163-B Canal St., New York.

MILLIONS Of prospects! Buyers everywhere! Sensational lifetime gold colored deluxe social security plates; case! Tremendous value! Fast seller! Big profits! Complete selling outfit free! Union Specialty, 1775-J Broadway, New York.

SELL Calling cards. Liberal profits. Outfit free. Universal, Orange, Mass.

SELL Our vest pocket size illustrated comic booklets. Send quarter for 10 different samples. None free. Reptsac Sales, 96 - 5th Ave., New York.

NEW Invention rids premises of roaches, ants, waterbugs, for a year. Homes, hotels, stores buy hundreds. Big profits. Write for distributor's trial offer. Rid-A-Tor Co., Dept. 39, Kansas City, Mo.

AMAZING Opportunity—Give away valuable premiums and samples with famous quality coffee, spices, 400 other necessities. Steady work—excellent pay. \$500.00 yearly bonus and free samples to all qualified dealers. Experience unnecessary. Part time workers welcome. Togstad Company, Dept. C-16, Kokomo, Indiana.

AGENTS! Big profits, mailing our literature. Home business. Stamford, 3762-D Broadway, New York.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. P. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

GUARANTEED Gold leaf letters for store and office windows. 300% profit. Free samples. Metallic Co., 438-B N. Clark, Chicago.

SAMPLE To smokers. Mail 6c in stamps—Sweet Tobacc, rich flowery tropical mix with a delicate aroma. Distributors wanted. Specialty Forum, 9441 Pleasant Ave., Chicago.

SELL Artistic oil painted personal portraits! Portraiture, 826 Noble, Chicago.

HIGH Grade window letters 1½c each. Free samples. Metallic Co., 438-A North Clark, Chicago.

FREE Sample world's best seller. G. Mfg. Co., Washingtonville, Ohio.

SELL Stores, taverns, gas stations 1939 sparkling 25c Gem signs. Cost 5c. Gem, 4277-M Harrison, Chicago.

500% PROFIT. Modernistic guaranteed Stick-on letters for windows, offices, trucks. Large sizes 1c. Easily applied. Free samples. Modernistic, B-3000 Lincoln, Chicago.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, P.O. St. Louis, Mo.

AGENTS—Opportunity make money; book containing 107 successful business plans; home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Ro-Co, 2810-R Dodder, St. Louis, Mo.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

STARTLING Invention—Pocket adding machine. Nationally advertised \$2.50. Whirlwind seller. Big profits. Baby Calculator Co., Box 1118, Chicago.

BIG Money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 40, Dunellen, New Jersey.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 149 Fifth Ave., New York.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 1107-P Broadway, New York.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

REVOLUTIONARY Window cleaning tool. Good Housekeeping approval. Only ten \$2.25 sales daily to housewives, factories, schools, stores will make you \$350.00 monthly. Carter Products Corp., 900 Front Ave., Cleveland, Ohio.

ATLAS Window sign letters. Large sizes, penny each. Beautiful free samples, Atlas, 7941 Halsted, Chicago.

"1,000 WAYS To Make \$1,000." You can do it—others have. This amazing book will startle you. 475 pages, only \$2.50. Popular Mechanics Press, Room (C38), 200 E. Ontario St., Chicago.

HIGH-GRADE SALESMEN

CITY And rural salesmen. Two for southern manufacturer rated at half million. Monthly earnings up to \$400 to \$800. Take orders for roof coating with the aid of numerous powerful, visual demonstrations. Used on warehouses, schools, garages, public buildings, etc. Also full line of paints. Credit plan gives buyer long trial before paying a penny. Earnings advanced. Experience in our line not required but sales ability and intelligence absolutely necessary. We start you at our expense. Write immediately for complete details. The Zone Company, Box 4313, Dept. A, Fort Worth, Texas.

DID You make \$50 last week? Does your job offer you real future? If not, why not start a wholesale business of your own? Start with little as \$2.50. Handle line 200 nationally advertised 5c-10c products. Show merchants new plan for increasing sales and profits. Handle everything from your home at start. Chance to operate one of our Silver Fleet service trucks. Facts free. World's Products Co., Dept. 10-C, Spencer, Ind.

SELL Business cards \$1.50 thousand. Business stationery, book matches, gummed tape, paper towels, advertising pencils, sales-books, rubber stamps, advertising specialties. Free sales portfolio. 35% comm. daily. Money making specials. David Lionel Press, 312 So. Hamilton, Dept. DO, Chicago.

MAKE More money with Red Comet Automatic Fire Extinguishers. Low price. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Bldg., Littleton, Colo.

DISTRIBUTORS—Supply revolutionary corn remover to stores. New sales plan results in landslide of orders. 150% profit. Exclusive franchise. Great Christopher Corp., Buffalo, New York.

THIS Ad directed to salesmen with sales ability. Application solicited for roof coating, paint, oil and grease proposition sold on long trial credit terms; no down payment. Earnings up to \$400 to \$800 per month. (Sworn statement.) Earnings advanced. No experience in our line needed, but intelligence and ambition are needed. Otherwise, please do not waste your time or ours. Panther Oil & Grease Mfg. Co., Box 4306, Dept. 106, Fort Worth, Texas.

POSITION Open paying salary and expenses based on small sales quota with nationally known manufacturer of standardized maintenance products. We want a salesman qualified to call on industrial plants, institutions, municipalities, school boards, real estate, insurance companies and large property owners. Protected territory. Old accounts given. Rapid advancement assured right man. American Asbestos Products Co., Dept. B, Cleveland, Ohio.

SALESMEN. Distributors—200 items brushes, mops. Marvelous magnetic brush excels vacuum cleaner. Big profits. Neway Brush Company, Hartford, Conn.

MORE Money in 1939 selling advertising book matches. Cash commission. Full or part time. Experience unnecessary. New outfit free. Gem Match. 72-PM West Washington, Chicago.

ADVERTISING. Specialty salesman! Sensational advertising pencil deal. Every business a prospect. Striking color assortment. Lowest prices. Big commissions. North American, D-554 Adams, Chicago.

INVESTIGATE New profitable industry. California Earthworm Farms, Highland Park, Los Angeles, California.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

AMAZING Seller. All weather coat guaranteed ten years, \$9.95. Commission \$3.00. Selling outfit free. Tenyear Raincoat Co., Dept. 20, Templeton, Mass.

FREE Samples—Red hot specialties. Jackson's, P-105, Kansas City, Mo.

RAWLEIGH Men make good money. Supply everyday household necessities to Rawleigh routes of 300 family users. Ambitious men can make good earnings at start. We furnish everything but the car. Write today. Rawleigh's, Dept. C-A-PPM, Freeport, Ill.

ADVERTISING Book matches—Sell union label book matches. Fastest selling line in America. Large sales producing kit, sample matches, complete cut catalog, eight color combinations make selling easy. Commission in advance. Superior Match Co., 7530 Greenwood, Dept. M-3, Chicago.

YOUR Own suits free. Other attractive bonuses and free shirt offer plus big cash profits for selling your friends quality tailored-to-individual measure suits. Five popular new low price ranges. Exclusive sport and swing styles no extra charge. Prices defy competition. Elaborate selection spring and summer new shades and patterns. Satisfaction or money back guaranteed by reliable thirty year old tailoring firm. No experience needed. Sample outfit free. Jay Rose & Co., Dept. P-3, 330 So. Wells, Chicago.

ADVERTISING Book match business now booming. Experience unnecessary. Big cash commission daily. Factory direct. Low prices and top quality assure repeats. Big sales kit free. Match Corporation of America, Dept. E-3, 3433 - 48th Place, Chicago.

LIVE Energetic salesmen to sell complete line of motor oils and greases. Shipment direct from refineries in Ohio. Pennsylvania, Wisconsin and other states. Roberts Coal Company, Memphis, Tenn.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Farrell cleared over \$1,000.00 monthly. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

BLADES. Finest quality. Factory prices, postpaid. Ace Blades, Buffalo, N. Y.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

EARN Money in your spare time taking subscriptions to Popular Mechanics. Unlimited possibilities, every family a prospect. Easy to sell. Bonus paid in addition to liberal commission. Send postcard for further details today. Circulation Dept., Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

HELP WANTED

STEADY Work—Good pay. Reliable man wanted to call on farmers. No experience or capital required. Pleasant work. Home every night. Make up to \$12 a day. Wonderful new proposition. Particulars free. Write McNess Co., Dept. 272, Freeport, Illinois.

WEAR Fine hose I send without cost with outfit while taking orders for amazing new hose. Replacement guaranteed against holes, snags, and rips. Rush name and hose size. Wilknit, Desk C-37, Greenfield, Ohio.

MEN! Earn \$5 daily extra. Retain your position. Sell beautiful etched metal social security plate and double cellophane leather case. 70% commission. Send your S. S. No. and 10c for agent's equipment. Wm. Hammet, 665 W. Lexington St., Baltimore, Md.

M. M. Earned \$267, three weeks, raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. We buy crops. Book free. United, 3248 Lincoln Ave., Dept. 63, Chicago.

BIG Money taking orders; shirts, ties, hosiery underwear, pants, uniforms, dresses etc. Sales equipment free! Experience unnecessary. Write Nimrod, 4922-BG Lincoln, Chicago.

EDUCATIONAL AND INSTRUCTION

LEARN Shorthand at home. John Woolven, Box 328, Augusta, Georgia.

FOR An extremely profitable lifetime business, operate a collection-credit agency. Free folder. Cole Associates, Syracuse, N. Y.

BECOME Practical scientific investigator. Modern, illustrated course. Thorough training by former agent U. S. secret service. Particulars free. International Secret Service Institute, PM-39, Hoboken, N. J.

1939 GOVERNMENT Jobs. Commence \$105-\$175 month. Prepare immediately at home for examinations. Experience usually unnecessary. Full particulars—list positions, free. Write today. Franklin Institute, Dept. H3, Rochester, N. Y.

WATCH Repairing is steady profitable work. Experts always in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., 2015 Manhattan Building, Chicago.

CARPENTERS—Pope's Simplex Roof Chart. All cuts, lengths, all rafters. Any roof, pitch. Guaranteed. \$1.00. Ed. Pope, Box 23, Sayre, Oklahoma.

INVENTIVE Minded can become independent! Explanation free. I. Higbee, Cantil, Calif.

STAMMERERS—A new, practical, easy way to cure your stammering at home. Very small cost. Not a school. Write for free literature. Carl, Box 771, Detroit, Mich.

KNOW Your mental strength. Invaluable information on mental powers, concentration, control, memory, etc. "Dynamental" twelve studies postpaid \$1.00. Dynamental, 9304 Amesbury, Cleveland, Ohio.

CIVIL Service arithmetic, 662 tricky problems, solutions, \$2; 667 mental questions, \$2; customs, meat inspector, storekeeper-gauger, postal, many others, \$1 each. List jobs free. Pergande Publishers, D11, Milwaukee.

GOVERNMENT Jobs available. Act immediately. Free information. Cooper, 2104 Colorado Building, Washington, D. C.

MANUAL Of locksmithing. Send for application. Christison's, 1019 - 14th, Denver.

PROFESSIONAL Slide rule. Prepaid, 25c. Gold Shield Products, 350-M Greenwich St., New York.

PROSPERITY For you. Revolutionize your life. Dime brings actual lessons in "Creative Procedure." Gardiner's, Box 6048, Kansas City, Missouri.

LEARN Linotype operating, photo-engraving, printing. Particulars free. Nu-Ideas, Carrollton, Illinois.

LEARN The practical way—Decorating, paperhanging, graining, marbling, sign painting, card writing, pictorial painting. Catalogue free. Chicago Painting School, 437 North Clark Street, Chicago.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration. Diesel. Stevenson's, 2008A Main, Kansas City, Mo.

LEARN Watchmaking. Complete instructions \$1.90. Catalog wholesale tool, material, watches 5c. Stewart's, 721 Olive, St. Louis, Mo.

TELEGRAPHY Taught thoroughly. Railroad retirement act creating opportunities for new operators. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

BOOKKEEPING Taught for as low as 40c weekly. Other home-study courses. Write for particulars. Institute of Business, Box 1055, Sacramento, Calif.

GOV'T Jobs start \$1260-\$2100 year. Men-women age 18-50. Former examiner's tested method helps qualify you. Particulars, list jobs free. Write today. Patterson School, 8C Mercantile Bldg., Rochester, N. Y.

HELP Yourself to success—good books put you on higher plane. Catalog—chemical and technical books for stamp. Kraftsmen's Press, Cos Cob, Conn.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

MASSAGE. Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

PLAYS, STORIES, MANUSCRIPTS

WRITERS. Turn your rejected stories into cash! Our pattern outline for radio play \$1 per story. Stories revised, typed, marketed. Barrett-Keenan Literary Service, 302 Fifth Ave., New York.

ORIGINAL Poems, songs wanted for publication, radio. Westmore Music Corporation, Dept. 33G, Portland, Ore.

SHORT Stories, novels forcefully revised, typed for marketing. Welton Tinney, Winnsboro, Texas.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

MONEY Making plans—Market guide—25c. Cartoon Studios, LaCrosse, Wis.

CHALK Talks. Laugh producing program, \$1.00. Catalog 10c. Balda, the Cartoonist, Oshkosh, Wisconsin.

CARTOONING Course: 30 illustrated lessons, over 500 drawings, pens and pencils. Sent complete postpaid for \$1.00. Scovell Studios, Box 748-P, Hollywood, Calif.

CARTOONING, Sketching, etc.—46 lessons, 600 illustrations, including drawing paper, pens, pencils, \$1.00 complete. Fraba Service, Cashton, Wisconsin.

PEN And ink illustrations for catalogue and general printing purposes at right prices. High grade work. Heraldic Studios, 1914 Oakdale Avenue, Chicago.

BE A lettering artist! Learn how to letter headings for magazine and newspaper advertisements. Highly paid profession. Free booklet. Guild School of Lettering and Advertising Design, 324 Summit Avenue, Hackensack, N. J.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

ADVERTISING Placed all magazines, newspapers, radio. Lowest rates. Free service. 54 page rate book free. Baker Advertising Agency, A-189 West Madison, Chicago. Successors to Ankrum. Established 28 years.

LEARN Advertising quickly at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue, Dept. 3431, Chicago.

EFFICIENT Advertising prepared for any business. 38 years experience. Newspaper, magazine, mailing-list free. Chicago Advertising Agency, 20-PE West Jackson, Chicago.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

ADVERTISE: 24 Words in 250 newspapers \$10. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

DIRECT-MAIL Advertising services. Sales letters that sell. Mailing lists. Omaha List & Letter Co., Box 2172, South Omaha, Nebr.

BUSINESS SERVICE

LOS ANGELES Mail address \$2 monthly. Dickey, 628 W 9th.

\$1.00 MONTHLY Maintains Detroit mailing address. Harry Wells, Baseline, Michigan.

CHICAGO Mail address \$1 monthly. Your personal, business mail forwarded daily. Established 1919. General, 56 West Washington.

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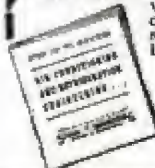
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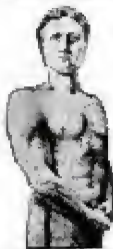


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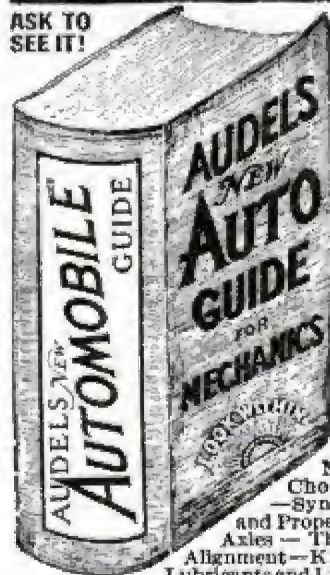
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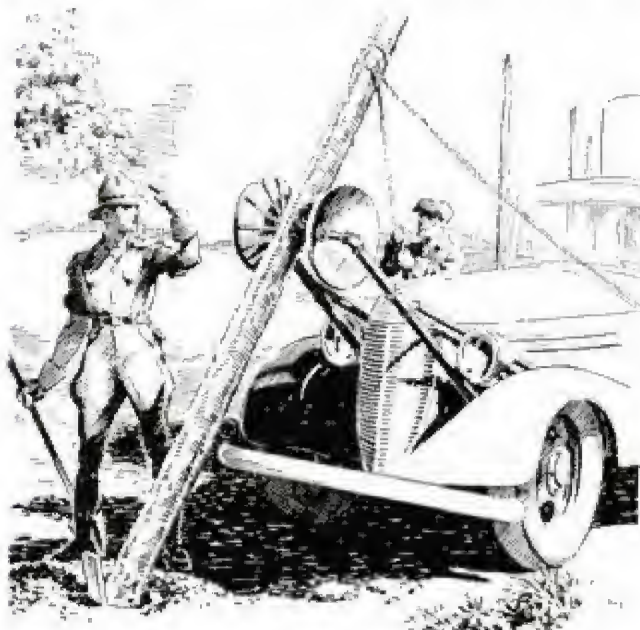
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NEW INVENTIONS

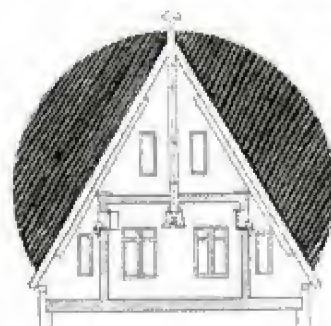
(Continued from page 33A)

INTENDED to reduce the work of erecting telegraph, telephone and other wire-supporting poles, a device for attachment to the front of trucks has just been patented. It consists of a pair of standards



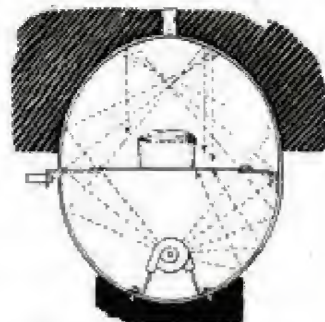
between which is mounted a roller. One end of the telegraph pole is set into the hole, at an angle, and the other is placed on the roller. By moving the truck forward, the pole is raised and set into the hole.

AIR conditioning for the home is provided under a patent issued recently.



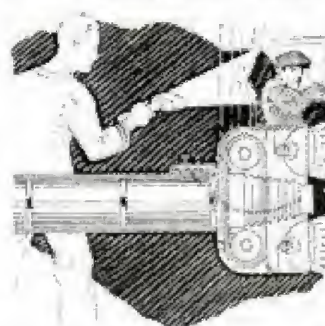
One phase of the invention is that of dehumidification of air, that is removal of moisture in the summer months. The system involves the use of a substantially hygroscopic substance and includes the steps of passing a current of air periodically over the substance while cooling the substance to cause it to absorb moisture from the air. Then the air thus dried is conveyed to the room to be conditioned. The system also calls for alternately regenerating the substance while it remains in operable position by exposing it to the sun. The heat of the sun causes the moisture to evaporate from the substance into the air.

BAKING biscuits and bread is too common to be of much interest to most people, but one inventor has found a new way of doing it. A recent patent covers a portable oven consisting of an upper and lower section. The upper section has internal reflecting surfaces parabolic in right cross section and the lower has an internal reflecting surface elliptic in right cross section. Rays from a heating element are radiated to the baking tray by reflection from the oddly arranged surfaces.



TAKING pictures at night is made easy by a combination flash lamp and camera patented recently.

Batteries are stored in the handle. The head of the flashlight is enlarged to house two lamps, complete with reflectors and lenses to produce concentrated light beams. Located between the electric bulbs is the lens of the camera.



SERVING the double purpose of beach hat and fan, a novelty costume article has been patented recently.



It consists of a single sheet of flexible material transversely pleated from one end to the other. When the two ends are joined by suitable means, the sheet forms a hat which may be secured to the head by means of ribbons.

Due to the fact that many of the devices described in this department are still in the patent office stage and are not on the market, Popular Mechanics Magazine cannot undertake to supply further information regarding them.

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Screen Play by Hugo Butler

A Metro-Goldwyn-Mayer Picture

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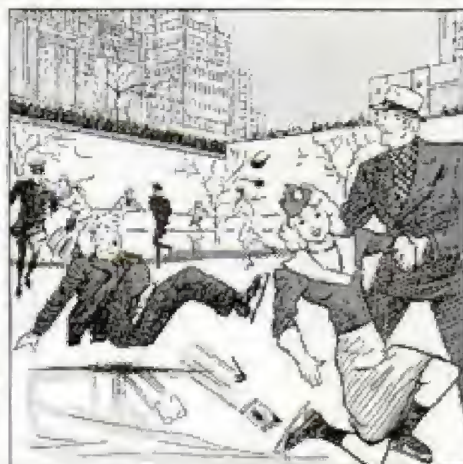
Produced by Joseph L. Mankiewicz

"The Wizard of Oz" (in Technicolor) now in production at the Metro-Goldwyn-Mayer Studios



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Vol. 71

MARCH, 1939

No. 3

H 1524 *The* CITY *of* TOMORROW



Views of model from which Democracy is being constructed in 200-foot Perisphere at New York World's Fair

By Henry Dreyfuss
Industrial Designer

As Told to Julian Leggett

THE city of tomorrow is going to stretch and take a deep breath and be a healthier and happier community because of that. It will be composed of a central town or "brain center" surrounded by satellite towns containing factories.

People who work in these factory towns are going to live close to their

501 Madison Ave. New York



Drawing of Perisphere with photo of 200-foot model of Democracy as it will appear to World's Fair visitors. Henry Dreyfuss is creator of the fair's theme exhibit, the central feature of which is Democracy, planned community of tomorrow

work. They will have a school and a movie. The resident of the satellite town will get up in the morning in a house pleasantly surrounded by green. He can walk to work and his children can walk to school in complete safety because they will never cross a vehicular street. When his wife goes to market, she can walk if she wishes, through a park, and she will shop in a park, since the stores will be situated around pleasant

green belts. She might drive, but she never would run the risk of killing anyone because no one will cross the highways.

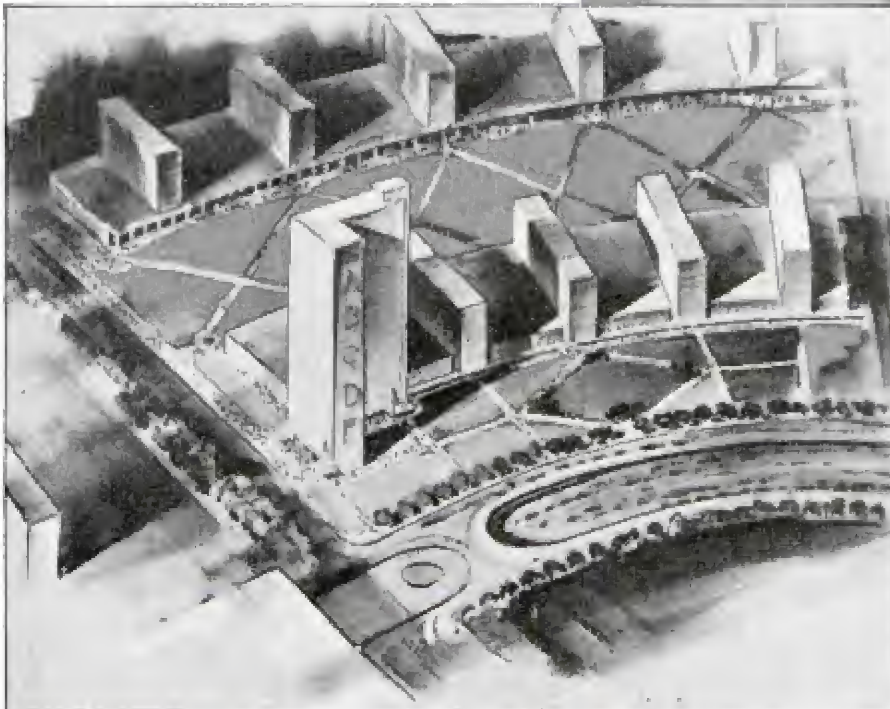
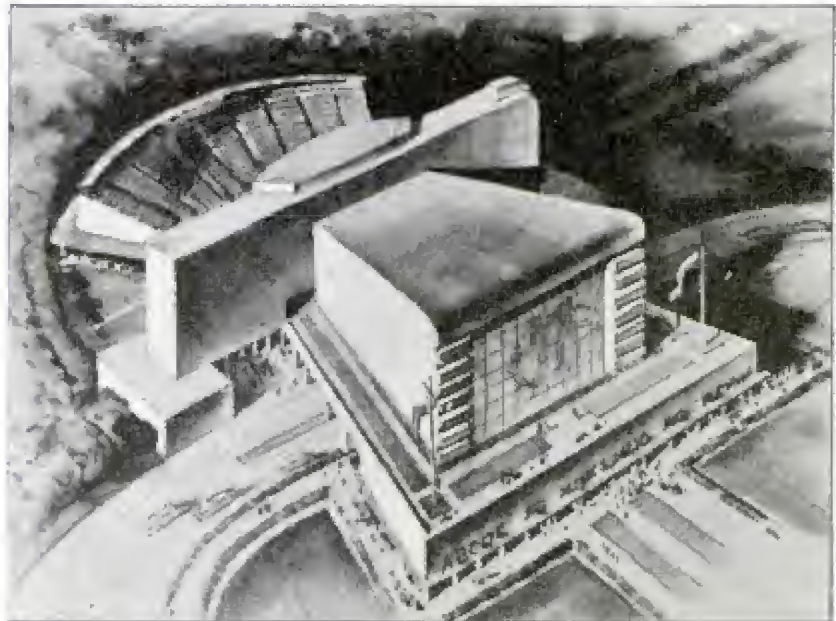
If this couple wants to hear the latest theatrical production, they will drive forty miles to the hub—to Democracy—over pleasant highways and right to the theater without a single traffic jam, because the city is planned for that very thing. They will park under the theater, see the per-

formance in air-conditioned comfort, then return home.

Their home, in the satellite town, will have a living room, bedroom and dining room facing a park, and a kitchen facing a highway. It will be painted in attractive colors—an individual house that will resemble no others on the street. The park facing the home will have a place to swim, and playgrounds for the children.

In the satellite town there will be a public market where the farmers living in the green belt will bring their produce. People will not eat concentrated food capsules; they will eat fresh green foods direct from the gardens. They won't have artificial flowers because they will get fresh ones from the garden. The family will develop good taste because they will be surrounded by good things—music, trees and other cultural advantages.

A man will be loyal to his employer because he makes this city possible. Today a man leads two lives—the life of his work and the life of his family. Tomorrow's city is



Top, Democracy's opera house, designed by Henry Dreyfuss, has reversible stage facing open-air amphitheater in summer and interior of theater in winter. Center, model of open-air restaurant. Bottom, shopping center of Democracy, as sketched by Theodore Kautsky

going to inject a third stage, which is playtime to improve his mind and body. The man of the future will be sufficiently educated so that he won't turn off the radio when he tunes in a symphony orchestra—he is going to appreciate that music. Perhaps he will have a shop in his home where he can do wood carving or some other form of handicraft. In fact, hobby shops may be run by the city.

(Continued to page 148A)

Chicago Tribune

12/27/38

152.4

141561

Glass Made Invisible as Air Does Not Reflect Light



Clear strip across middle of portrait compares non-reflecting glass with untreated glass above and below

Ordinary thicknesses of glass are made as invisible as air by stopping all reflection of light with a coating of oily film. Glass usually does not pass all of the light, but reflects about eight per cent from the surface, creating the glare you see from pictures framed in glass, display windows and clock faces. By applying to the surface of glass a very thin chemical film about four millionths of an inch in thickness, or exactly one-quarter of the wave length of light, Dr. Katharine B. Blodgett of General Electric's research laboratories has been able to remove all glare and reflection. Light rays reflected from both the outer and inner surfaces of the oily film are caused to counteract one another, since rays coming from the outer surface are equal in intensity and opposite in phase to those reflected from the inner surface. Discovery that a film of insoluble soap one molecule thick can be spread on the surface of water furnished the key to the secret. Glass is treated by dipping it through this floating film and the dippings are continued until about forty-four layers are built up. Light transmission of a piece of

glass was increased from ninety-two to 99.2 per cent with this treatment. Although not yet commercially available, the process can be applied to lenses in cameras and telescopes. In showcases, display windows and clocks the glass would be invisible and eyeglasses would not reflect light beams from the sides or behind the wearer.

141553

Two-Wheeled Submarine Auto Explores the Ocean Floor

Believing the ocean floor is the next frontier for the prospector in search of mineral and marine wealth, Simon Lake has built a two-wheeled electric automobile for submarine exploration. Inventor of the first successful open-sea submarine, Mr. Lake designed his latest deep-water vehicle for peaceable commercial use. It is operated by a crew of four. Propeller and wheels are driven by electricity drawn through cables from a surface ship. Mr. Lake anticipates the submersible car will be used to hunt oil and gold on the ocean floor, to locate sunken ships and "farm" oyster and sponge beds and to carry cargo on new trade routes in the arctic.

Pat. # 2,125,301



Notice the observation windows, the propeller and fore and aft wheels in two views of submarine auto

Simon Lake, New York

see mar. 1940 - 129a

Schenectady N.Y.

2

MILES
A
MINUTE!

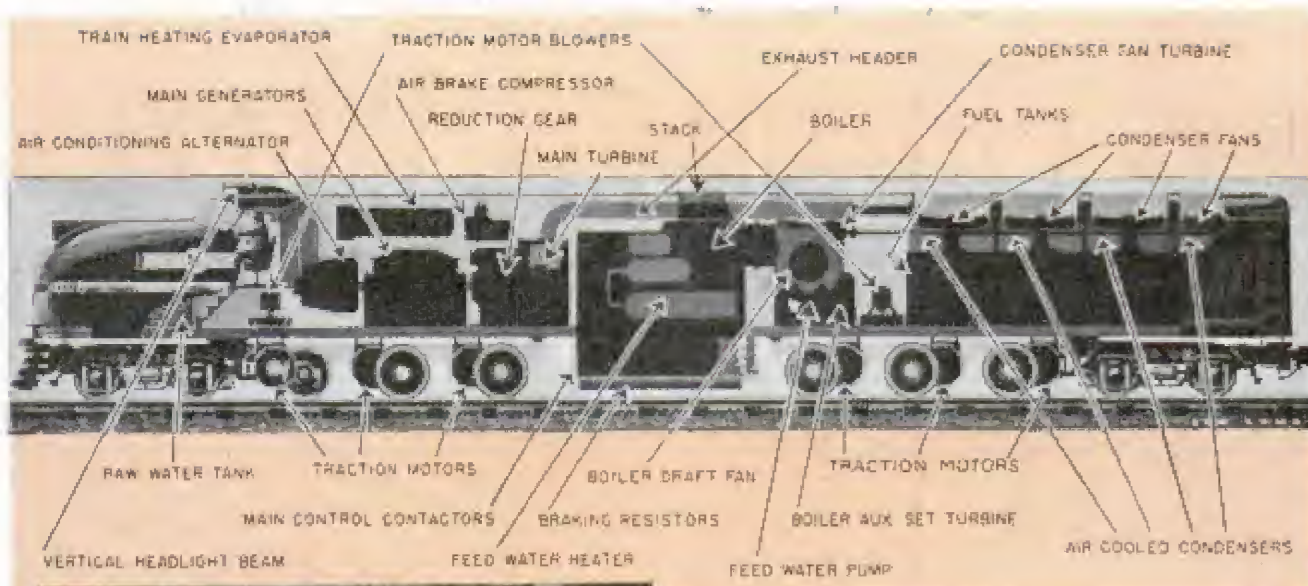
TURBINE *on* WHEELS



CARRYING its own steam-turbine power plant and capable of doing twice the work of the conventional locomotive for each pound of fuel, a new type of streamline electric locomotive built for the Union Pacific railroad is rated at better than two miles per minute. Using a steam turbine to generate electricity for its six driving motors, the new rail giant develops 5,000 horsepower. It operates on a low grade of "bunker" oil, even cheaper than that used by Diesel engines, because the fuel is burned in a firebox instead of in an internal-combustion engine. Turbines and the turbo-electric drive are not new, but this is the first time in this country that either has been applied successfully to rail-traction purposes. The engine has two cabs. The boiler uses forced circulation of the water through the tubes surrounding the furnace. Forty-five thousand pounds of steam are generated an hour to a pressure of 1,500 pounds at a temperature of 920 degrees Fahrenheit. The steam, after passing through the turbine, is condensed and used



Top, steam-electric locomotive. Bottom, engineer in cab of streamline giant. Note the automobile-like windshield and windshield wiper

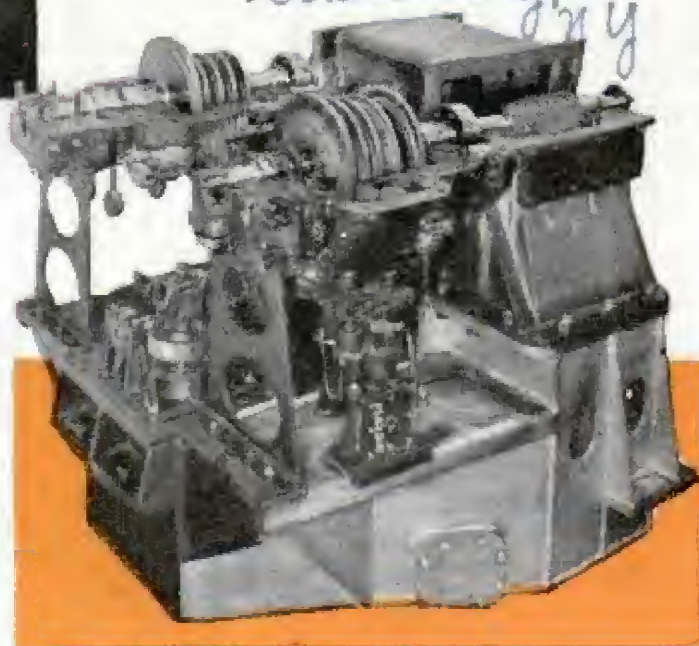


Above, sketch showing principal parts of "turbine on wheels." Left, interior of cab showing control equipment. Below, turbine and gear with cover removed from top half

motors act as generators when the train is coasting, is employed, enabling the engineer to glide to smooth, easy stops. This type of braking reduces wear on brake shoes and eliminates disagreeable grinding of brakes. This locomotive is powerful enough to handle the heaviest standard train equipment from Chicago to the Pacific coast without a change of engines and without a helper on mountain grades of the Union Pacific line. It is designed to operate at 110 miles per hour for long periods. Economical use of fuel and water will permit runs of 500 to 700 miles without stops. Mechanical and electric parts were made by General Electric company.

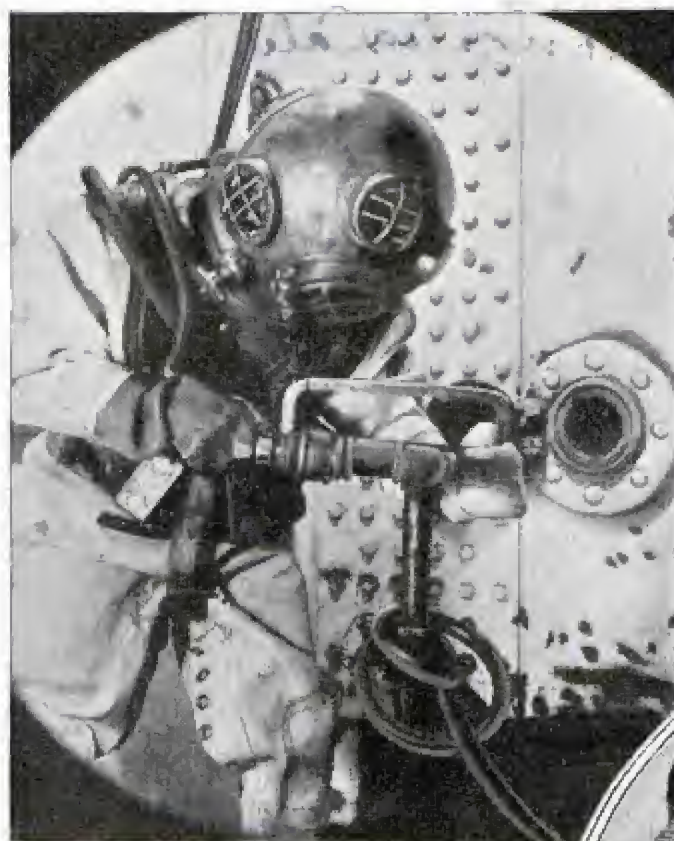
Schenectady, N.Y.

again and again, thus requiring no additional water for running the locomotive. Additional water is necessary, however, for heating passenger coaches. A feature of the equipment is introduction of completely automatic operation. When the engineer increases power and speed in the cab, the flow of fuel to the boiler also increases. Only a few minutes are required to raise the pressure from zero to full steam pressure, thus avoiding long delays in putting the locomotive into service. Control of electrical equipment also is automatic. Electric braking, whereby the driving

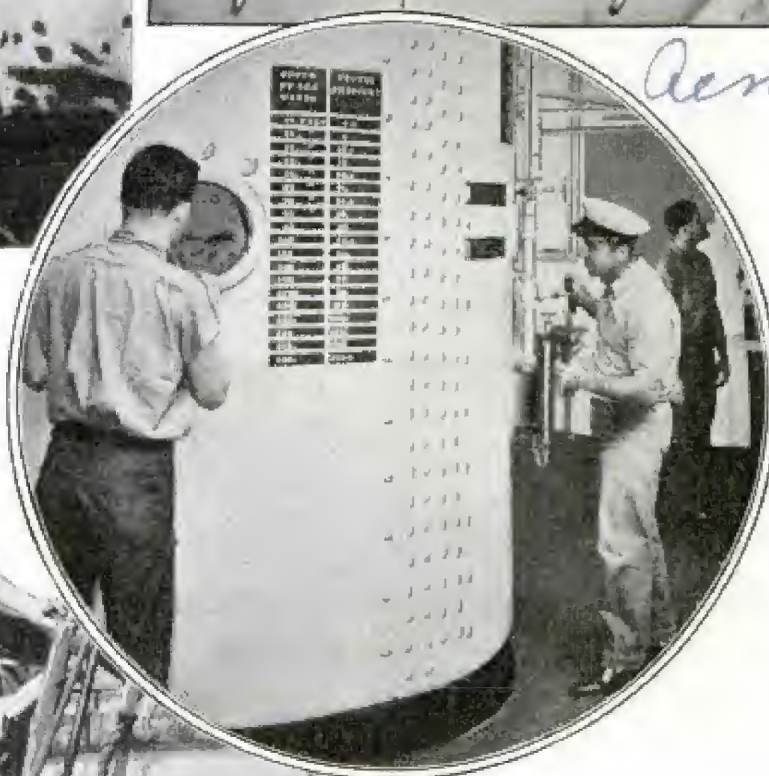


1465

School for Sea Divers Has Classroom in Tank

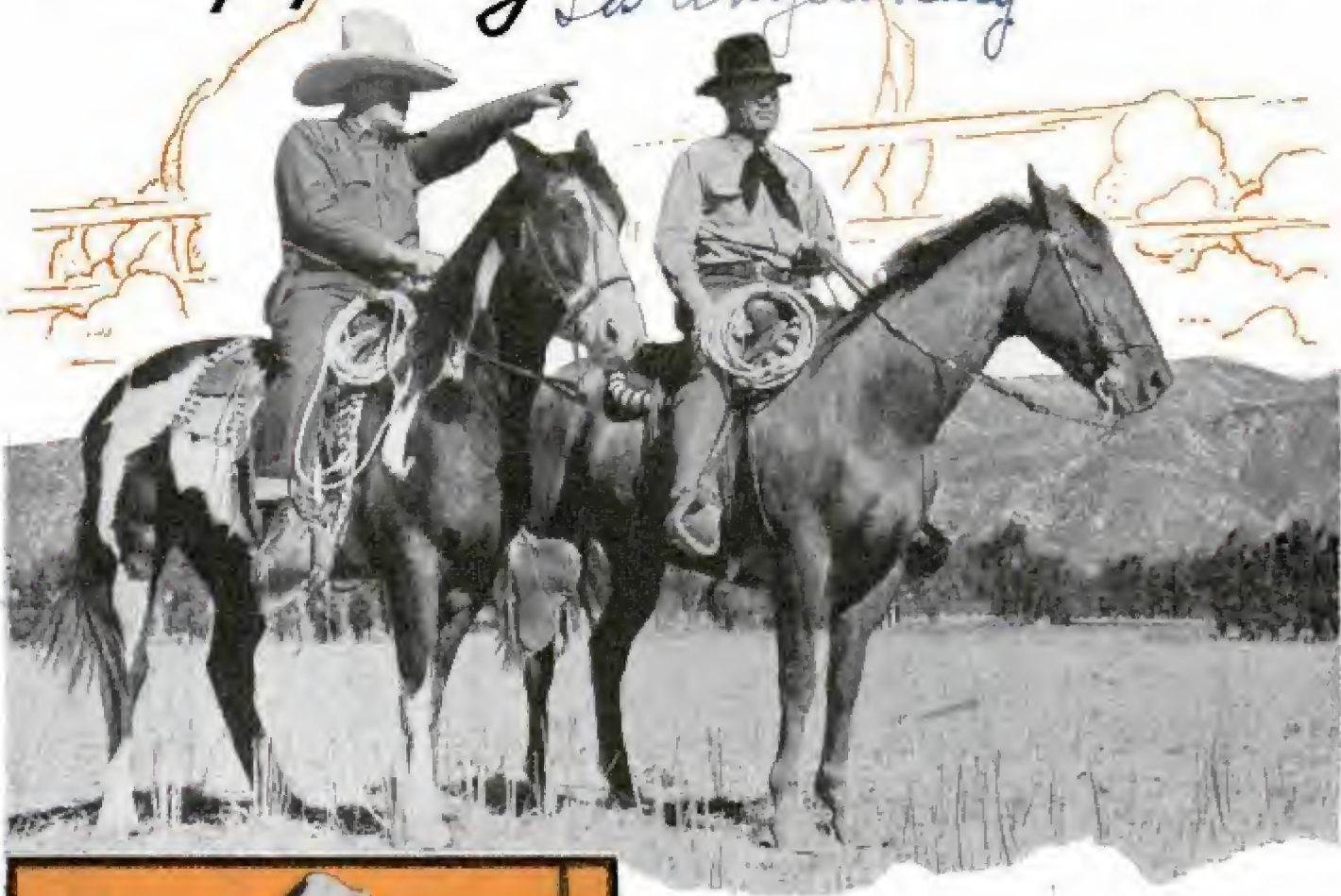


Deep-sea divers of the U. S. navy are sent to school before attempting salvage work. They work in a tank under pressures corresponding to 300 feet under water. Above, left, diver inside tank learning to use a hacksaw on a pipe line. Right, instructor and student undergoing decompression to avoid the "bends" after a dive in the tank



Above, through portholes instructors watch divers at work in a large tank and talk to them by telephone. Left, after twenty-six weeks of indoor training the diver is given practical lessons in underwater flange fitting, also oxyhydrogen and electric arc welding. Classes are selected from among petty officers for the school, and graduates are designated "divers, first class." Skilled divers go down to recover documents from sunken U. S. vessels to keep them from enemy hands; also secret signal and code books are sought from sunken enemy ships in time of war

1440
Cmt Thomas E. Simpson, Jr.
10565
Trapping MODERN
Los Angeles, Calif

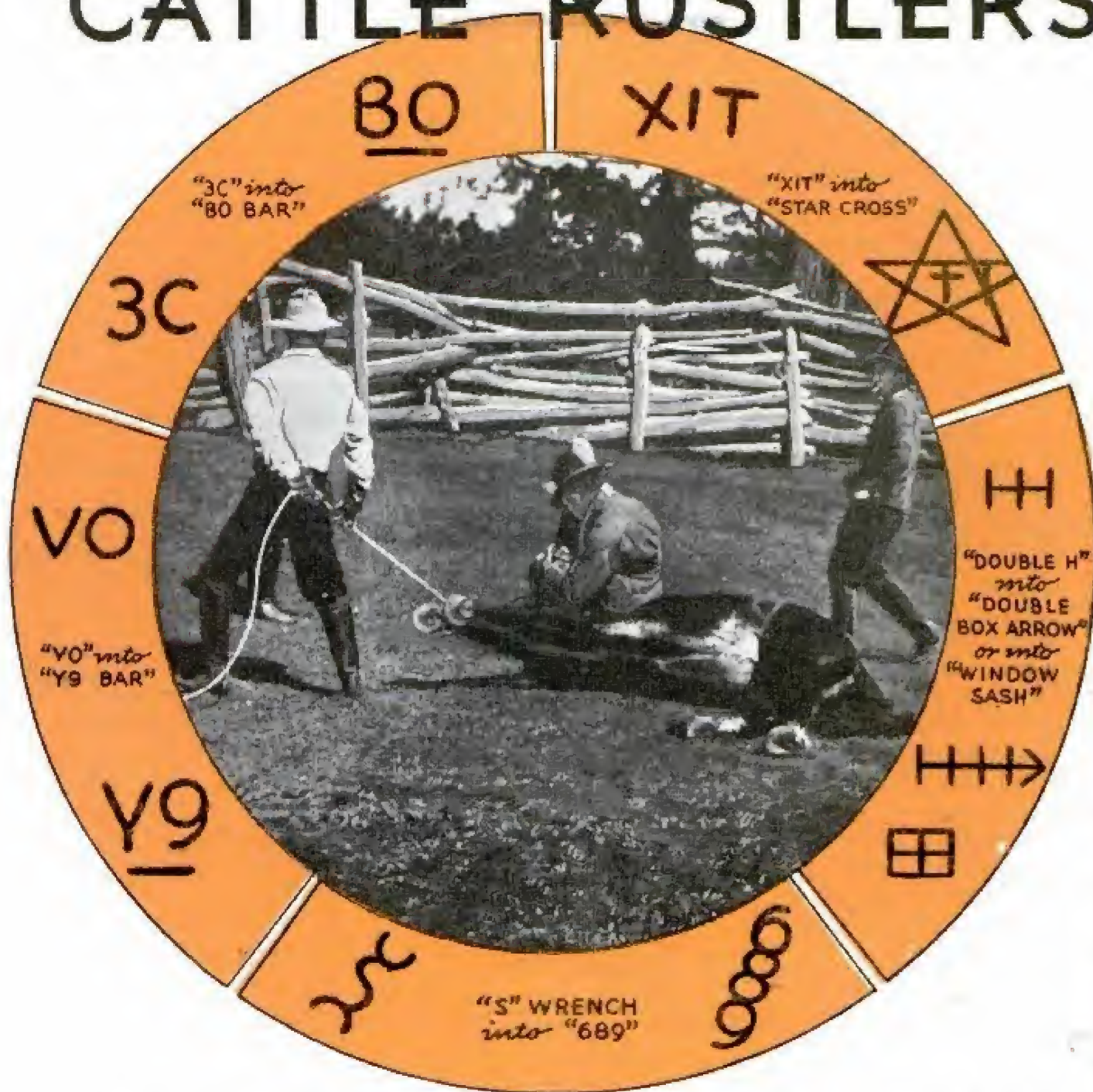


Top, deputies searching for evidence. Bottom, examining collection of branding irons

CALVES were being stolen from the range, the stock detectives felt certain, but they couldn't prove it. The only evidence was the constant bawling of some of the cows, indicating that their calves had disappeared. Occasionally a spot was found that looked as though a calf had been butchered, but there were no tire marks or footprints or even a suggestion that footprints had been brushed out.

The detectives were fighting in the dark but they got their man. The range was too big for adequate patrols and it was impossible to investigate every rancher for 100 miles around on mere suspicion, so they tried another way. They decided who was the most logical suspect, waited until he started on a truck trip and then searched his camp. Not a single bit of suspicious evidence was found until one of the detectives curiously turned over a pair of large shoes. That was all they needed. On the bottom of each shoe was attached a wooden plate carved to the shape of a

CATTLE RUSTLERS



Cow punchers preparing to brand saddle horse. The border illustrates how brands may be altered by rustlers to conceal cattle thefts. Note how the "VO" brand (left) is changed to "Y9"

cow's hoof. The rustler had been parking his truck along a road and walking into the range and out again leaving tracks just like a cow's.

Cattle rustling is about as prevalent in most parts of the west today as it ever was. Modern Hereford range cattle are worth more than the stringy long-horn animals of the past and in addition they have become used to the presence of men and automobiles, making it easier to capture them. Losses have been estimated as high

as a million dollars a year in the cattle states, although an exact figure is difficult to reach, since a ranch owner may not discover a theft for weeks or months after some of his cattle have been stolen, or he may never learn of the theft. That is because, with thousands of animals spread out over a range that measures several hundred square miles, an owner may not count his cattle more than once a year.

Once inspectors at the Los Angeles stock yards sent a wire to an Arizona cattlemen's



"The 1939 cattle thief is apt to have a fast truck and trailer into which he can load thirty head of stock and speed off at forty miles per hour," Capt. Mace remarks. "The next morning he unloads at some point several hundred miles away. The night's work may represent a haul of \$1,500. The rustler may live in a city and thus be hard to trace. He may butcher cows or calves on the range, burying their hides on the spot to eliminate the identifying brands, and peddle the meat to unscrupulous retailers. He may rework the brands on animals, chang-

association, advising them that they were suspicious of a recent shipment of 300 cattle, worth \$10,000, and representing nine different brands. The inspectors were holding the cattle in Los Angeles and they wanted to know whether the shipment was bonafide. Then the telegraph wires started to sizzle. The owners of the animals had thought their cattle were safe on the home ranges and none of them knew of the shipment. Rustlers had rounded up the stock, stolen some Arizona brand inspection slips, filled them in, and used them to bluff the railroad into carrying the cattle to the coast. All of the law-breakers were caught.

Cattle stealing the modern way is far different from old-time rustling on the range. Veteran stock detectives like Capt. C. E. Mace, supervising inspector of the Livestock Identification Service in the southern part of California, have seen the rustler abandon his horse and his practice of cutting out a band of cattle from a herd and running them off through the night in favor of more up-to-date methods. In twenty years as a stock detective Mace has arrested scores of rustlers.

ing the original brands to a symbol he has registered himself. He has a sleeve full of tricks but the peace officers and vigilante associations have just as many."

In some parts of the west "gasoline cowboys" ride the highways, stopping every truck that carries cattle to see that the shipment papers are in order. There are standing rewards for catching cattle thieves. Gun duels are still fought on the range. A county sheriff may have an area



Top, examining brand marks of different herds. Bottom, cowhands reading notice of \$200 reward for arrest of cattle thieves

of new stock yards. Los Angeles.

as large as Massachusetts under his jurisdiction with only a few deputies to uphold the law and he welcomes the assistance of ranchers who are ready to use their guns freely. The radio, teletype, and telephone help prevent the escape of cattle thieves after they have been detected, and the modern roads that help the rustlers also help the law-enforcement officers.

In California, where stock raising in all its



Top, snipping hair to inspect brand. Center, examining tire tracks after cattle theft. Bottom, deputy broadcasting message to officers on the range

branches is one of the most important industries, cattle rustling is on the wane. Vigilant stock owners and detectives have made it difficult to steal cattle and harder still to sell them. Taking the profit out of the old-time practice is putting a stop to it. The state-operated Livestock Identification Service arrested more than seventy people for cattle stealing last year, mostly in cases that represented only one or two animals instead of the wholesale thefts of the past.

Taking the profit out of rustling is ac-

(Continued to page 145A)

Lawnmower Shovels Snow When Winter Comes



Snow removal is easy with this gasoline-driven plow which will go back to cutting grass next summer

Double service is obtained from the gasoline-driven lawnmower by making it plow snow in winter. Mechanics in the park department of Duluth, Minn., removed cutting blades from the machine and substituted fiber brushes, which are set diagonally to throw the snow off to one side. The snowplow has cleared sidewalks of snow several inches deep.

Self-Starting Pressure Siphon Lifts Heavy Liquids



Air pressure and vacuum alternating in a self-starting siphon causes liquid to begin flowing by lifting it in the tube when a rubber bulb is squeezed and released. The siphon removes thick cream for whipping without pick-

ing up the milk, and it will transfer jelly from the cooking pot to glasses. Where different kinds of liquids separate themselves in the container, the top one may be drawn off without disturbing the others. Fruit juices, acids, chemicals, ink or aquarium water thus are easily siphoned, leaving the pulp or sediment untouched.

Rubber Exhaust for Motorboats Eliminates Corrosion

To avoid the corrosion that attacks metal exhaust pipes in the water, an exhaust hose made of rubber and duck is offered for motorboats. When unburned fuel mixes with water in an exhaust pipe, a weak solution of sulphuric acid forms, resulting in corrosion of the metal pipe. The flexible hose, its inner tube made of heat-resistant rubber, its outer cover oil-resistant, is unaffected by acid or salt water.

Full-Vision Fireproof Eyeshield Guards Entire Face

Protection for the face and clear vision in all directions are combined in a transparent eyeshield for industrial workers. Made of flexible and fireproof material, the guard sheds hot metal. An adjustable headband holding the shield is equipped with a removable sweatband to keep perspiration out of the eyes. The shield does not interfere with spectacles.



Flying particles and hot metal will glance or roll off this eyeshield which does not obstruct vision

Facsimile Newspaper Printed on Home Radio

Radio took over the newsboy's job recently when the St. Louis Post-Dispatch began regular broadcasting of a specially prepared facsimile newspaper, which was received on a home "scanning" set of tabletop size. At a rate of fifteen minutes per page, the receiver unrolled duplicate pages of news, sports, photographs, cartoons, radio programs and gossip, and financial news. The broadcasts were experimental, to test the practicability of transmitting



Top, transmitter scans "master" copy of newspaper; left, reading facsimile as it comes from home receiving set



newspapers on ultra-high-frequency waves; receiving sets were placed in fifteen homes. The original printed copy of the four-column, eight-and-one-half inch newspaper is placed, a page at a time, on a cylinder in the transmitter. As it revolves seventy-five times per minute, it is scanned by a photoelectric "eye" and the variations

of light reflected from the black and white pages vary the outgoing radio waves. The process is reversed in the receiver. Continuous rolls of paper and carbon paper pass over a metal cylinder from which a small stylus projects. Pressure, varied by the radio waves, is exerted on a metal bar parallel to the cylinder, and the black and white of the original printed page is duplicated. There are no dials or adjustments for the reader to operate. A clock turns on the receiver for the broadcast and stops it at the conclusion.

Street Barriers Slow Up Automobiles to Control Traffic

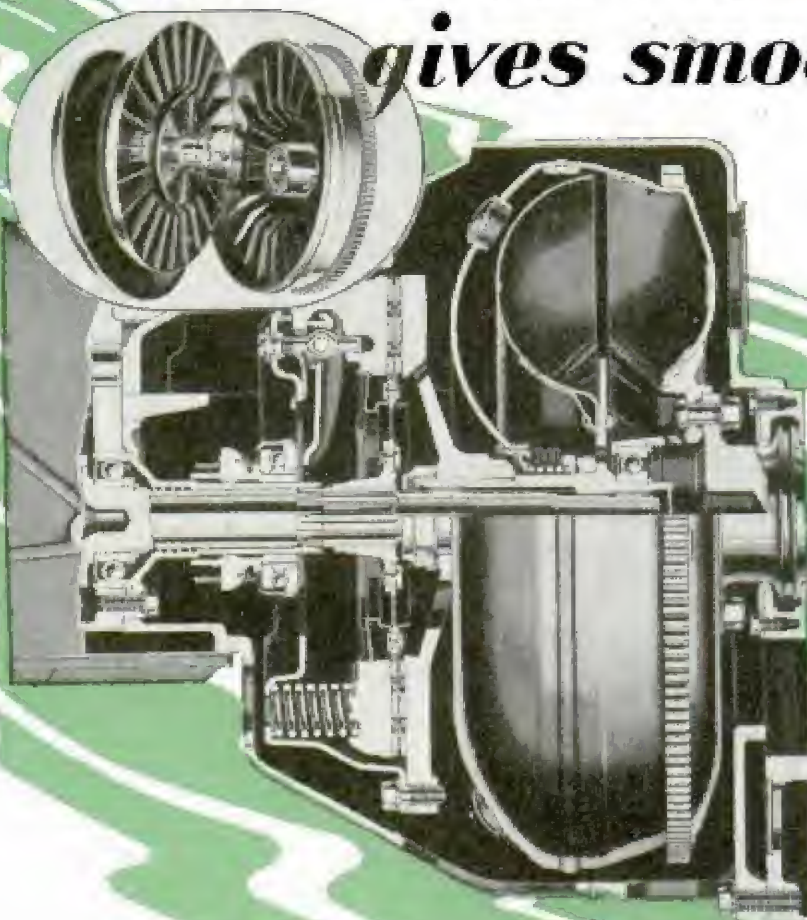
Giving the government full control of traffic entering Jerusalem and other Palestine cities, concrete blocks are erected at strategic points along the highways to slow down all cars, which must thread their way through in a zigzag course. It is impossible for an automobile to make any sudden advance or to speed past the guards stationed in the concrete tower at the roadside.



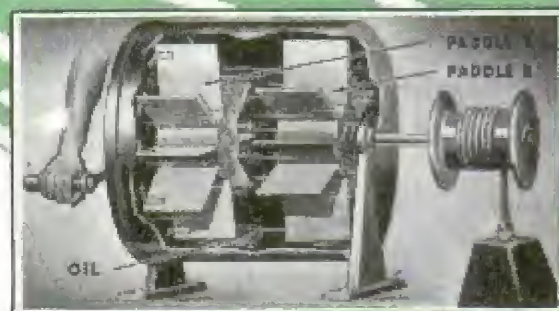
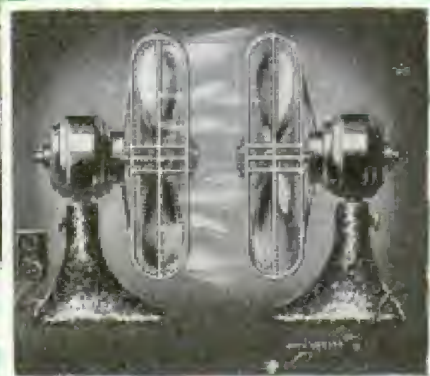
Autos slow down for inspection when they meet these barriers

FLUID DRIVE

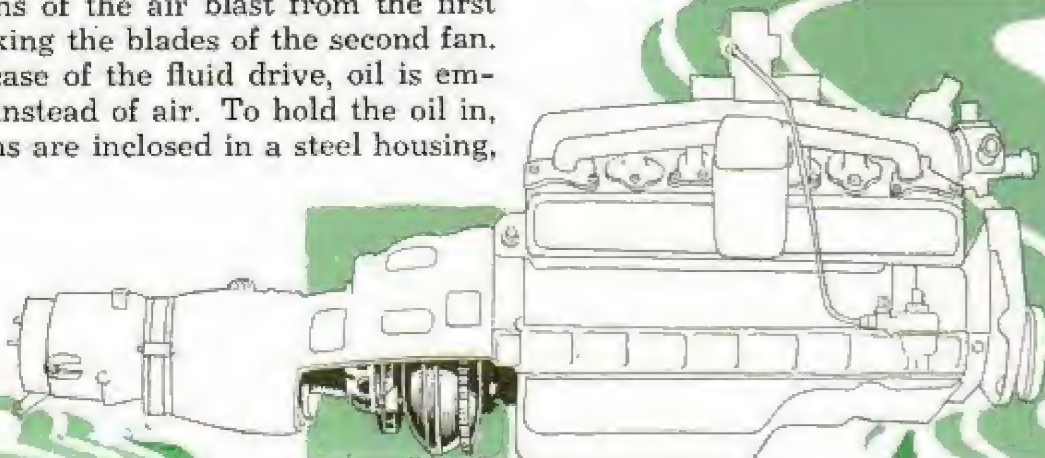
gives smoother ride



Left, cutaway showing driver and runner paddles. Inset, drive housing open to show fins. Center, electric fans and hand-turned paddles illustrate principle of drive. Bottom, outline showing position of drive between engine and drive train



IMPARTING to the gasoline-driven automobile the smoothness of a steam or electric-powered vehicle, a "fluid drive" is standard equipment on the 1939 Chrysler custom imperial line. It is a device for transmitting power from the engine to the rear wheels. Under ordinary conditions it permits driving the automobile without using clutch or gear-shift lever. The principle is similar to that in which one electric fan starts another facing it by means of the air blast from the first fan striking the blades of the second fan. In the case of the fluid drive, oil is employed instead of air. To hold the oil in, both fans are inclosed in a steel housing,



which is nearly full of the fluid. One of the fans, which now becomes a paddle since it is moving oil, is attached to the crankshaft of the engine. Facing this paddle, called the driver, is a second paddle, called the runner, which is connected to the rear wheels through a suitable drive train of conventional type. Hence, in operation, the engine turns the first paddle, or driver, which pumps oil through the blades of the second paddle, or runner. The moving oil causes the runner to turn, thus turning the rear wheels. There is no mechanical connection between the driver and the runner, hence none between the engine and rear wheels. This is what makes operations of the fluid-drive car so smooth, since no shocks are transmitted through the oil. The driver, which is attached to the engine, always turns a little faster than the runner, attached to the rear wheels. This difference in speed between the two members is called slip. In driving on a level road at normal speeds, the slip is very low, about one per cent. But under heavy loads at low speeds the slip becomes greater and reaches its maximum when the car is left in gear while the engine is running and the car is stopped. This does not kill the engine, as in the ordinary automobile when brought to rest in gear without releasing the clutch. The fluid-drive car may be started smoothly from a standstill in high gear simply by releasing the brake and stepping on the accelerator. Gear shifting is unnecessary. Declutching when stopping also is unnecessary because the engine will not stall. Thus unskilled drivers have less difficulty in operating this type of car, particularly in making smooth starts. The fluid drive damps out all torsional vibrations originating in the engine, thus reducing shock and wear and tear on the whole driving train from engine to rear wheels. The car may be driven as slowly as desired in high gear without declutching and there will be no engine bucking. When starting the engine it is unnecessary to shift out of gear or declutch. When slowing down, the engine may be used as a brake, just as in the standard car.

Truck Loaded with Giraffes Avoids Low-Bridge Highways



Giraffes thrusting their heads out of covered truck at one stop on the transcontinental trip to their new home

When two giraffes were transported across the United States recently by truck, a special route was selected to avoid low bridges and overhanging electric wires. The giraffes were shipped from New Jersey to the San Diego, Calif., zoo.

Push-Button "Freezes" Needle on Cop's Speedometer

Disputes about a traffic violator's speed are quickly settled if the policeman's motorcycle is equipped with a push-button speedometer. A "high-speed needle" in the instrument, stopped by thumb button control while the officer is chasing the speeder, substantiates the policeman's word by recording the speed at the time of contact.



Pressing button with thumb "freezes" speedometer needle to keep record of traffic violator's speed

used by Evanson

X-Ray Exposes Tire Flaws and Hidden Nails to Driver



Top, motorist examines tire through window of X-ray "inspector." Below, shadow of nail and tire cut seen in machine

Automobile owners may look directly through their tires with the aid of an X-ray inspection machine announced recently. Nails, broken cords, glass and bruises stand out clearly as smudges and cracks on the X-ray window, thus revealing weaknesses that not even a tire expert could detect. In one test of the tires on 100 automobiles, the machine revealed that ninety-nine per cent of these cars carried one or more hidden tire dangers. Another investigation of 2,000 worn tires produced 2,049 nails and tacks, 2,099 pieces of glass and 2,197 pieces of rock and small stones which had become

lodged either in the tread or deeper in the body of the tire. In addition, a number of tires showed breaks in the cords, as well as other defects that eventually would have resulted in a flat, or possibly a blowout. Detection of these hazards takes only a few minutes. After the car is jacked up, the tire X-ray is rolled under one wheel. Protective flaps confine the rays to the section of the tire being inspected. The operator turns a crank to rotate the wheel. When any foreign object or defective section of cord is revealed, it is immediately spotted, automatically marked, and the inspection continues. Once located, the foreign objects may be extracted quickly with special tools. In addition to its value as a safety factor, the tire X-ray is a money saver. Firestone engineers say that tires given this inspection have a mileage life well beyond the normal expectancy of a tire that does not receive such attention. They point out that the machine should play a part in the reduction of the forty million flats which occur in this country every year, at the same time preventing many an accident.

Supersensitive Photo Meter Has Full Minute Range

So highly sensitive that it can be used in dim indoor light as well as in the brightest sunlight, an exposure meter for photographers has an extremely wide range, running from 1/2000 second to a full minute. No reading is taken while aiming the meter, but a simple ring adjustment is made. This lines up all possible combinations of film speed and exposure time on the dial. The meter is operated by a cobalt steel magnet and a photocell.



Firestone Tire and Rubber Co. Ann. deliver

Photovix Co. 10514 Leipsdorf Ave. Cleveland, Ohio

*James H. ...
431 W. 60th Street
Kansas City, Mo.*

MIRACLE *of* NEW COLOR MOVIES



DOROTHY LAMOUR and Ray Milland, wearing shiny "elephant" hat, as shooting begins on "Her Jungle Love," new Technicolor romance of the tropics made by Paramount Studios.



Paramount
ART staff, above, preparing sketches for color motion picture, "Men with Wings." Left, set sketch by Lyle Wheeler of interior of the royal hunting lodge in "The Prisoner of Zenda," a production of Selznick International Pictures.

COLOR moving pictures are a miracle in mechanical ingenuity. Mistakes of the pioneering days have been forgotten and one by one the major studios have rejoined the march toward an all-color screen.

Just when that objective will be reached is a question. Enthusiastic producers say it will be within a few years, others believe its general adoption will not come until television begins making inroads on the popularity of moving pictures.

One thing is certain: color movies are here to stay. Modern Technicolor is true color. There are no compromises in the spectrum and the color camera is now capable of reproducing whatever is placed in front of it not only as to color but also as to light and shade.

Technicolor's engineers, in collabora-

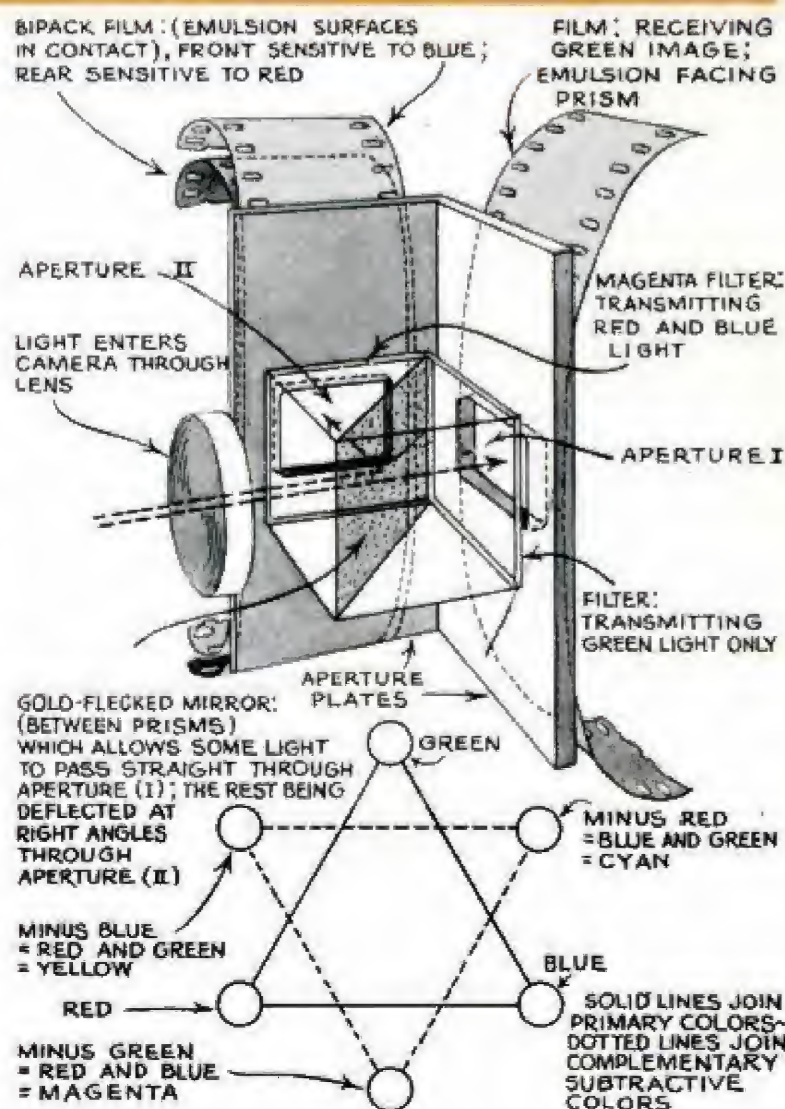
tion with Eastman's research staff, are working on a multi-layer or monopack process which can be operated through a regular black-and-white camera. It will be at least another year before the new film emerges from the laboratory, but when it does, engineers predict black-and-white films gradually will disappear.

In the present color camera, a system of prismatic mirrors and light filters shunts red, green, and blue rays of light to three different negatives as they are exposed simultaneously through a single lens. The result is three films recording in black and white the intensities of these colors.

By means of a special photographic process, positive matrix films of gelatin are prepared from these negatives. These three gelatin reliefs are then dyed with their complementary colors. The dye



PICTURE of camera used in making Technicolor motion pictures. Right, sketch which shows how the color camera operates.



next is transferred onto another film strip which receives its images one above the other and contains a faint key image in gray silver to aid in definition and registration. The finished product is a series of colored pictures, blended in every hue, like a fine job of color printing.

The monopack film will convert Hollywood's black-and-white equipment into color cameras. It also will simplify the taking of color pictures so film shooting schedules and cost sheets may be drastically cut. An immense amount of work on the monopack process was done by the late Dr. Leonard T. Troland. His findings indicate two methods of how the monopack might be applied to Technicolor's requirements.

The more important one calls for a film with an emulsion sensitized in strata to each of the primary colors. At the outset, the entire depth of the emulsion is sensitized to a single primary color. Two-thirds of the depth subsequently is relieved of its color



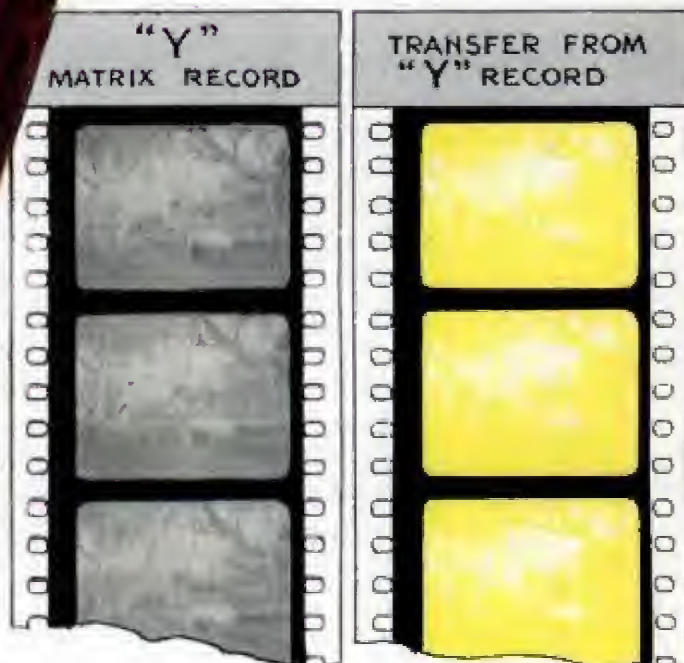
Tommy Kelly - Artist

SHOOTING scene in Technicolor picture, "The Adventures of Tom Sawyer." Left, watercolor sketch from which set was built. Bottom, strip running onto next page, record of each color, with the dyed transfer next to it. The transfer is made to a blank ribbon of positive film and the colors, printed one after the other, blend and give every possible color combination.



sensitivity and the remainder is then dyed to the second primary color. Here again the dye is removed from one-half of the remaining two-thirds of the emulsion so this portion may be sensitized in the same manner as the other two levels to a third primary.

After being exposed and developed, the entire negative is bleached in a tanning bath, changing it from an opaque negative to a transparent film and at the same time hardening that



127052

HERE is the finished print, obtained from the blending of colors in the manner shown at bottom of page. This is the same scene, now imprinted on color film, as that shown in the process of being photographed (on opposite page) with aid of the water-color sketch just to left of the set.



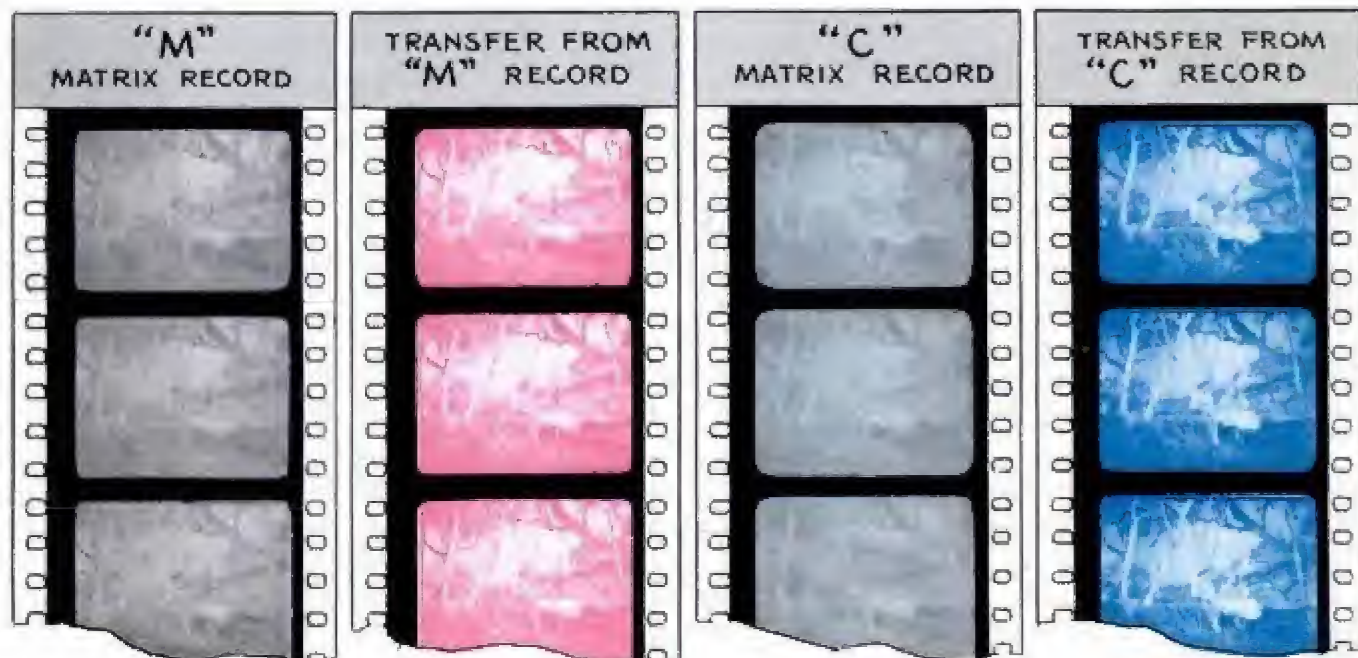
portion of the gelatin that is in contact with the silver grains. The gelatin not containing silver grains remains soft while that of the middle tones toughens in proportion to the amount of silver it contains. In other words, a film is produced with a coating of gelatin that contains three strata of hard and soft areas.

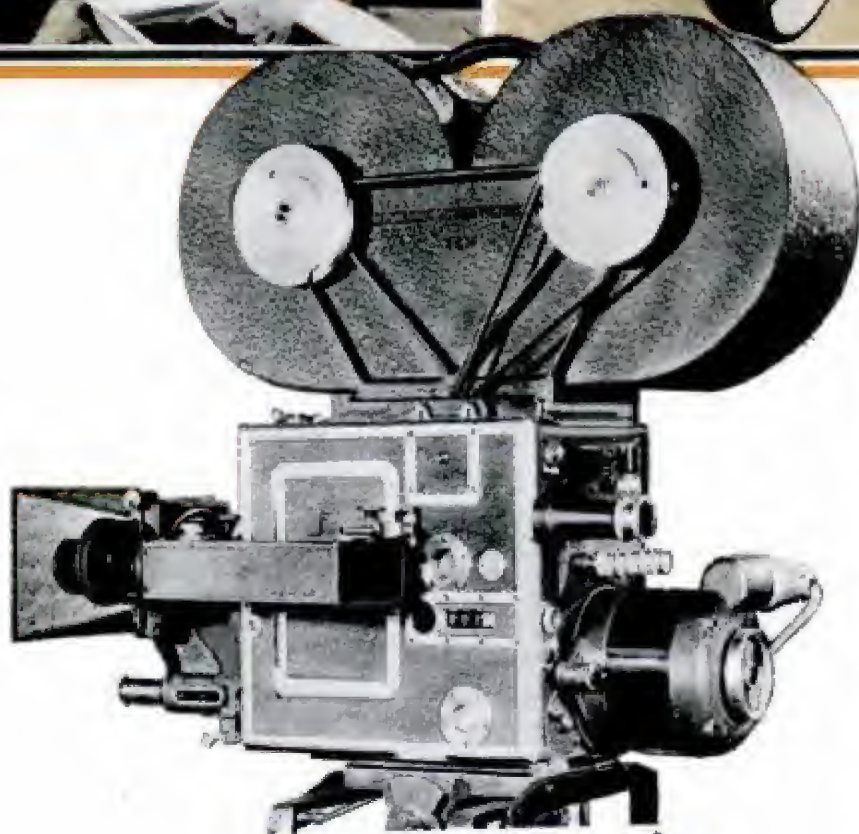
There are certain types of dyes that will color soft gelatin strongly without affecting hard gelatin, and the next step is to stain the tanned film strongly with one of these dyes that is a non-actinic color, that is, one that will permit only those rays of light to pass that will not expose a photographic film. When completed, this results in a positive of all three color impressions.

The dye is removed from the top two layers, leaving a positive of the bottom

layer in a non-actinic color. From this positive is printed a negative and, having accomplished one-third of the objective, the positive is freed of dye.

The film is again stained non-actinic, only this time the dye is stopped when it has penetrated through the second layer. When the dye is extracted from the top stratum, a positive of the middle-layer impression is obtained. A negative is made from this section of the film. Again the dye is taken out of the original film and the remainder is dyed non-actinic for the third and last time. A negative also is made of this layer, thus making one for each of the primary colors. From these negatives, which accomplish the same purpose as the three exposed in the present Technicolor camera, gelatin matrices can be made and



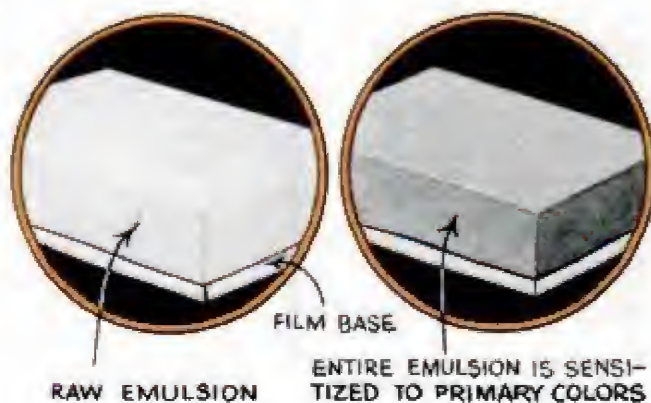


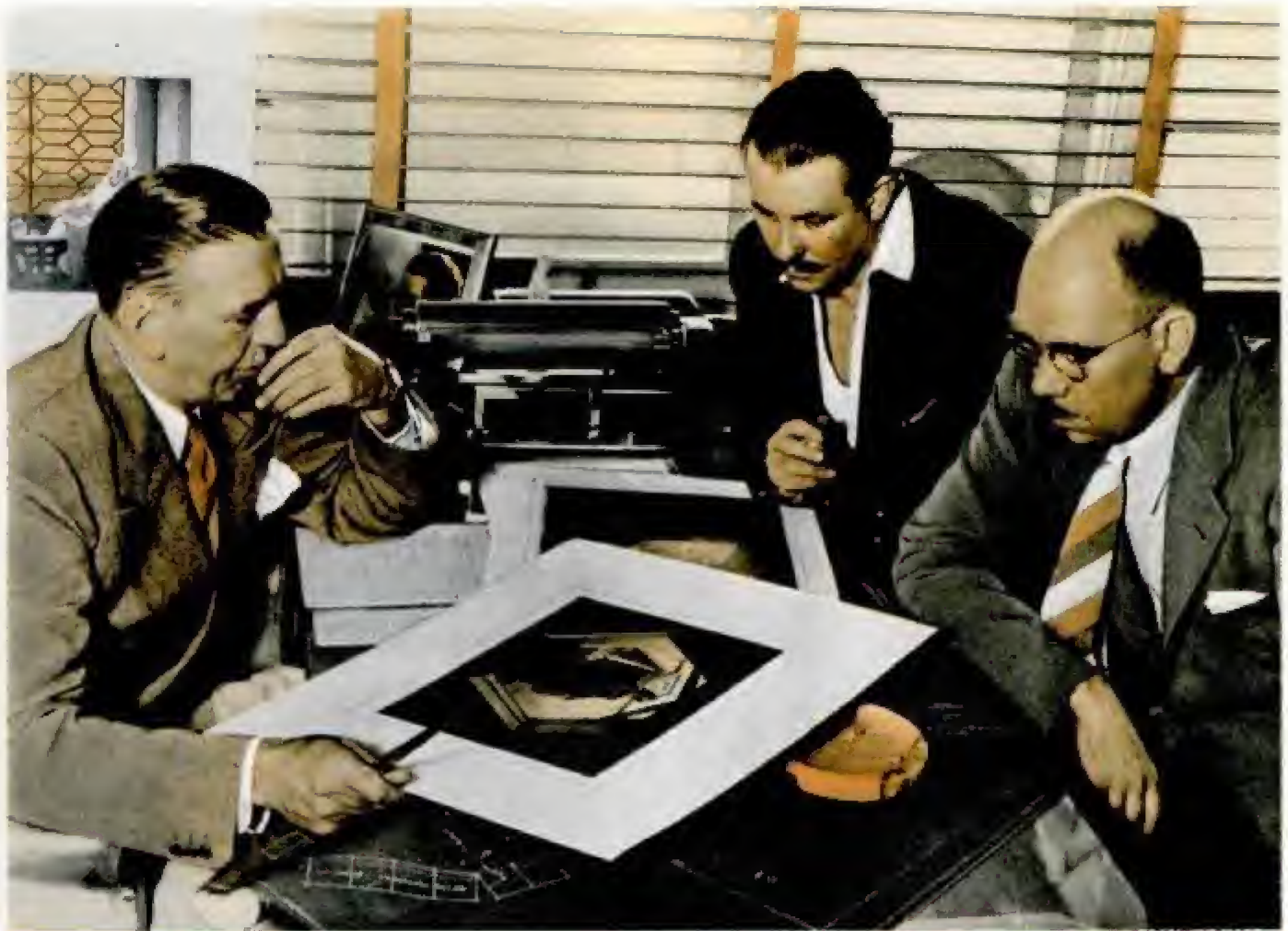
prints turned out by usual laboratory procedure.

The second way of obtaining a monopack is with a film similar to Kodachrome in that three layers of emulsion are combined into one.

Through a judicious use of color values, unusual depth can be given a picture. This is traceable to the fact that a cool color can recede, while a warm color can advance. For backgrounds, neutrals, buffs, tans, and grays and grayed-out tones of cool colors are used. Then by using combinations of warm and cool colors in the costume and set dressing, the characters stand away from the background and are given modeling and relief not possible in black and white. This same technique also serves to concentrate attention on the principals since it is only necessary to reverse this pro-

Lyn Fayre
Paramount Studios
F. E. IVES, top, left, pioneer in color photography. Center, craftsman preparing color set. Right, Artist **Groesbeck** executing "visualizations" of pictures to serve as guide for composition and lighting. Below, closeup of Technicolor camera through which three film negatives run at same time. Bottom, and extending on opposite page, diagram of process by which colors are applied to film by sensitizing the emulsion to one color at a time.





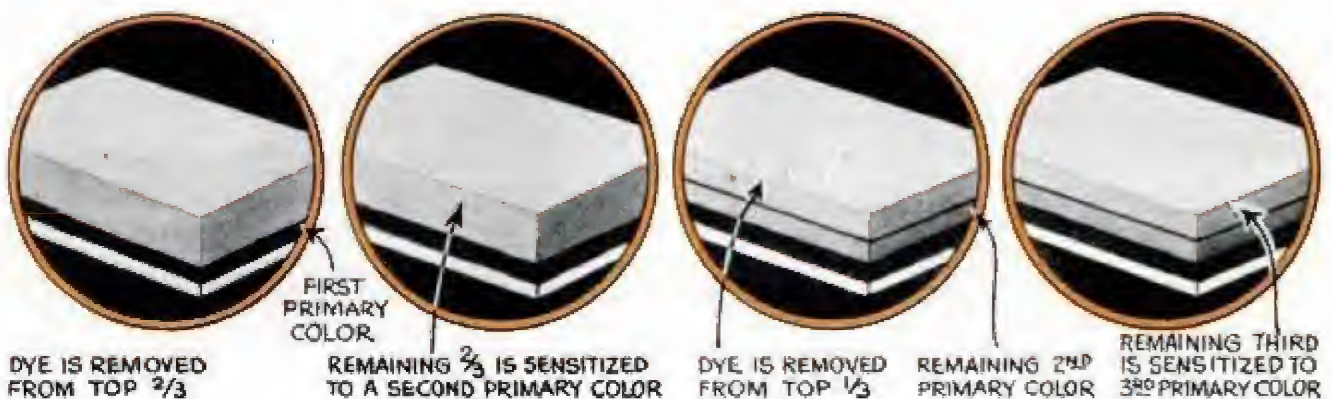
STEPHEN GOOSSON, art chief at Columbia Studios, conferring with Paul Murphy and Lionel Banks on plans for a new motion picture.

cedure to keep secondary and extra players unobtrusive.

"The color of a motion picture," explains Natalie M. Kalmus, ace colorist of the film capital, "is presented to audiences in a highly concentrated manner on the small area of a theater screen where values not obvious to the glance of a casual observer in everyday life become vastly more pronounced. It falls to the colorist to simplify and diminish in intensity the small distracting areas of color not important to the story or to the characters. Also, the colors in a

particular scene must harmonize with those in the scenes preceding and following it."

Color balance also must be maintained in each individual scene. Color values of walls, properties, and set dressing are carefully planned to be complementary to the important players in the scene as well as being in harmony with each other. Not only are certain materials tested for color but texture as well because certain window drapes, for instance, will absorb too much light while others will reflect too much.





TECHNICIANS, top, preparing for single scene in Paramount's "Ebb Tide," a Technicolor production. Bottom, Artist Flannery of the Paramount staff prepares a sketch for Technicolor film, "Men with Wings." Every step in a color movie must be planned carefully and executed with the utmost precision.

When a story is ready to be put into production, the first step is to determine its color key, that is, the proper colors that fit the story and the people who are to play in it. If it happens to be a light musicale, pastel shades such as hydrangea blues, daffodil yellows, and pinks may be used as these suggest gaiety and laughter. But for something more serious, say, an adventure story, sepias, marrons, olive and bottle-green shades fit the mood.

Color combinations are worked out so they build toward a climax. Scripts are scanned, too, for big moments, possible color highlights, where color goes beyond its normal function to supply a dramatic wallop.

Such a highspot occurred in "The Adventures of Robin Hood" when King Richard and his followers threw off their somber black cloaks and hoods, revealing the red and white Crusaders' tunics and
(Continued to page 128A)

Electric Voice with a Keyboard Really Talks



Left, two views of keyboard, covered and exposed. Above, the talking machine

First machine in the world to create speech, an electrical device demonstrated recently is operated by pressing keys somewhat like those on an old-fashioned parlor organ. A skilled operator, by pressing the keys singly or in combination, can make the machine carry on a conversation, stating facts, asking questions or emphasizing words. Built of apparatus used in everyday telephone service, the machine is provided with equipment corresponding to the two kinds of speech sound. One kind of sound is made by forcing the breath through the mouth, past tongue, teeth and lips, a sort of hissing employed in pronouncing s, th and f. In the machine there is an electrical hiss, and with some of the keys the operator can control its quality to make those sounds. Other keys make

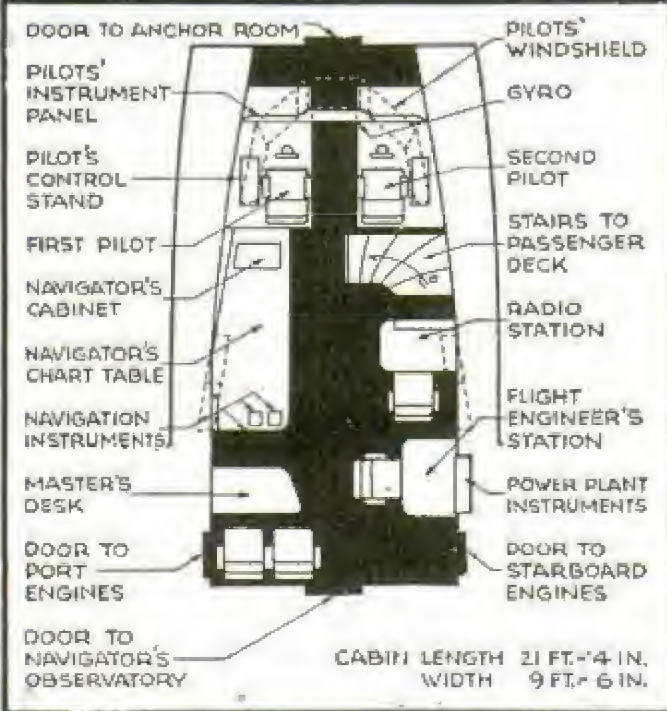
the "stop consonants" like d, k and p. Another kind of sound, that used in the vowels, like a, e and o, comes from the vocal cords and is very complex and somewhat musical. In the talking machine is an electrical source of sound corresponding to the vocal cords. A pedal permits changing its pitch and giving it a rising or falling inflection. When the operator wants the sounds made by the vocal cords, instead of whispered sounds or consonants, an arm-rest switch is depressed. Then the particular parts of this vocalized sound which are wanted are created by playing the proper keys. The source for this sound is the "relaxation oscillator" which gives a saw-toothed sound wave in contrast to the smoothly rounded wave of a pure musical note. The machine, which is called the Voder by its creators, Bell Telephone engineers, produces tones of a woman or a man at the turn of a knob. Bleating of sheep, lowing of cattle, grunting of pigs and even the rat-a-tat of the woodpecker also can be produced by the Voder.

Laboratories, 111 / New York

On the "Bridge" of the Greatest Sky Clipper



Top, radio operator and flight engineer; below, forward view of roomy supercockpit. Left, sky clipper in flight and diagram of control room

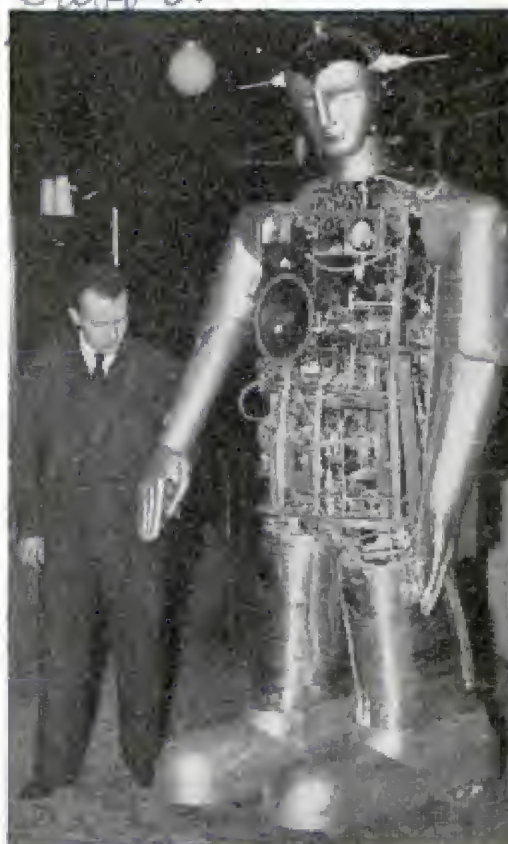


On the "bridge" of the greatest of flying boats, Boeing's seventy-four-passenger clipper, six officers are intent upon the maze of controls and instruments that surround them. It is a maze to you, but in reality it is simple, for the pilots have been relieved by navigator, radio officer and flight engineer of all but manipulation of the flight controls. Efficient yet roomy, this supercockpit is twenty-one feet long and nine and one-half feet wide; soundproofed, carpeted, comfortably furnished to avoid fatigue. First and second pilot sit forward, with dual controls and instruments: altimeter, air-speed dial, rate of climb indicator, turn and bank indicator, artificial horizon and directional gyro. Between these are the gyropilot, tachometers, manifold pressure gauges, compasses, outside air thermometer,

Boeing Aircraft Co., Everett, Wash. Station

clock, flap position indicator, gyropilot pressure gauges and instrument vacuum gauge. At the navigator's station are a seven-foot chart table, cabinet and instruments. There is an overhead turret for celestial observations and two drift sight stations under the wings. Opposite the navigator sits the radio operator, with three transmitters, three receivers and the radio direction finder. Just back of him is the flight engineer, responsible for the power plants and the calculation of power and fuel required for the flight. Facing the engineer is a panel carrying twenty-six instruments—tachometers, fuel quantity and flow indicators, oil temperature and pressure dials, air-fuel ratio indicators, a potentiometer showing temperature at two cylinder heads and cylinder bases of each engine; and, among others, an indicator which would detect presence of carbon monoxide in the heating system and shut it off automatically. In addition, the engineer has individual engine and propeller controls, mixtures and pressure regulators and hand-operated emergency fuel pumps. One dial shows up water in the fuel tanks, and there is a power-operated fire extinguishing system. An important safety factor is easy access to every motor during flight. Final authority is the master, who sits behind the navigator, correlating the crew's functions and directing the flight.

Lifelike Radio Robot Speaks, Walks and Lights Cigarette



© Planet News, Ltd.

Left, "Sabor's" jacket is removed to show the complexity of its mechanism. Right, the robot lighting a cigarette for its inventor.

After ten years of work, a Swiss inventor has completed a lifelike robot seven feet tall and weighing 400 pounds. Controlled by radio, "Sabor," as the robot is christened, walks forward, backward or sidewise, and forms words correctly with its lips in speaking. The mechanical man will answer questions and can light its master's cigar.

Shock-Absorbing Ice Crusher Protects Glass Tumbler



Chopping ice cubes in a glass tumbler without chipping or breaking it, a five-pronged crusher absorbs all jar with aid of a bronze spring inside its wooden handle. The prongs are first embedded in the ice, then the handle containing a hammer is moved up and down gently, driving the prongs through to crush the cube. Tension of the spring placed between hammer and prongs dampens the shock and prevents injury to the glass.

Apex Products Corp.

PAUL REVERES of '39



Night rider, left, speeds through citrus groves and telephones temperature reports to central office. Right, lighting smudge pot to save fruit from frost damage



AS THE man runs between the trees, the beam of his flashlight cuts through the darkness. The finger of light searches for a moment, finds what it wants, and stops. The man swings open a small box, glances at a thermometer within, then moves on, running for a telephone pole silhouetted against the moonlit sky.

He jerks from its case a transmitter, climbs up the pole and plugs in.

"Jones calling from station forty-five. Temperature twenty-eight and still falling." Then he climbs down, runs to his car, and speeds away.

He is a modern Paul Revere, awakening the countryside to war—a war to save 50,000,000 dollars from the specter of the dropping thermometer. Throughout hundreds of square miles around his speeding car are row on row of some of the world's finest citrus trees, their branches heavy with green fruit—fruit that may be blight-

ed before the first ray of sunlight breaks the grip of the cold.

This is the story of an organization whose job it is to awaken 10,000 men within two hours and send them stumbling into the night, their sleepy eyes searching for smudge pots while their numb fingers fumble with flaming torches.

From early November until the end of May the danger of a killing frost is always present in the southern California citrus belt. In 1935 alone a single frost caused \$60,000,000 damage.

To prevent such disasters, growers were forced to stay awake night after night, watching thermometers and listening to frost warnings over the radio. On the majority of these nights no frost occurred, with the result that the grower wasted the entire night and was unable to work the following day.

The situation needed a man with an idea.

BATTLE FROST



The man's name was Paul Smith. Working with the growers, he organized the Central Citrus Protective Association, which covers the entire San Gabriel valley.

That warning message phoned in by the rider was picked up on one of a bank of phones in the office of the Protective Association. In that little, crowded room twenty men and girls sit around a "U" table, headphones clamped to their ears. In the center of the "U" is Paul Smith. The message from the rider comes to him. Almost before the message is completed, Smith turns to one of the girls at the table.

"Call numbers 106, 107 and 109," he says, "and tell them it's twenty-eight and to get out of bed and start firing—and do it quick."

As the girl calls the growers corresponding to those numbers, Smith turns back to his phone to take a message from another rider. All along the table tense voices are making and answering calls. One grower



Top, frost fighters gather around flaming smudge pot for a moment's relaxation. Below, arousing orchard-men with telephone warning of freezing temperature



Above, filling smudge pot from oil truck. Center, flaming smokeless heater on guard in orange grove. Bottom, taking dew point and temperature at weather station

is informed that the temperature in his vicinity is still safe, and that he can go back to sleep; another is brought from his bed with a cheery:

"Hello, Anderson, frost warning calling. Better get up, it's down around twenty-eight at your grove. Sure I know you were up last night, but that's not going to do any good tonight. Come on, get your pots going."

In another office a man bends over a map across which runs a maze of circles and wavy lines. He is a meteorologist. It's his job to calculate the all-important relation between temperature and dew point and to predict whether a wind will blow away the frost or a sud-

den temperature rise will make smudging unnecessary. He makes a final check of his map, and reaches for his overcoat and gloves. Two miles away in the center of a grove is a "key station" where a recording thermometer, a barograph, and a wet-bulb thermometer will give data for his next prediction.

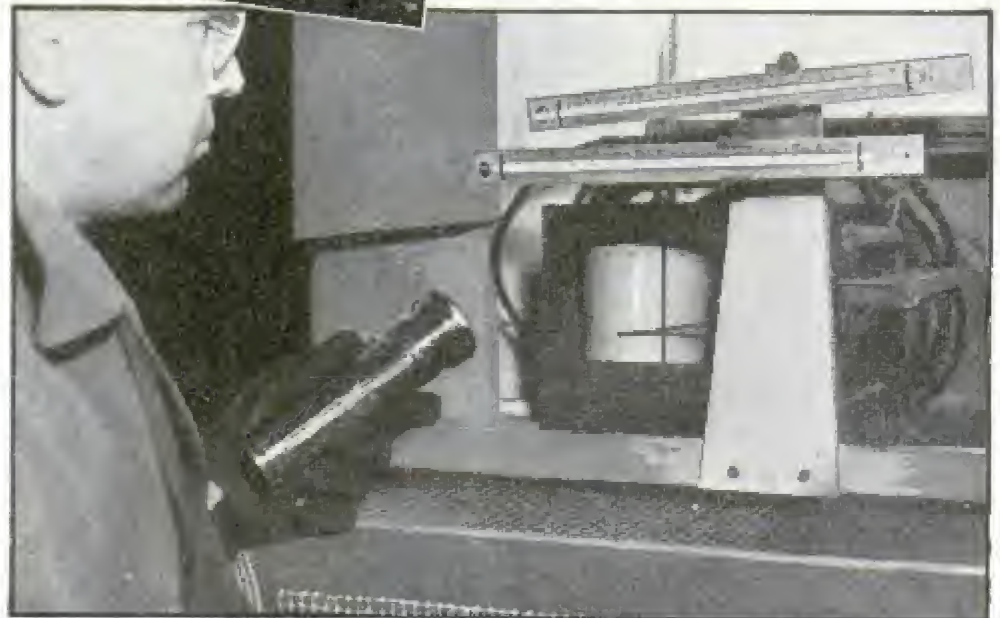
Before he leaves the room, he snaps on the short-wave radio. From the regional offices of the U. S. Weather Bureau come the latest data collected by stations strung over an area of half a million square miles, from ships at sea, and lonely observers on mountain tops. An observation made on a tramp steamer in the Pacific and that made in a grove are both part of the same vast organization with which human ingenuity is fighting the icy fingers of frost that reach for those billions of lemons, oranges and grapefruit.

At the key station, the weather man notes the reading and plugs in a phone. He is instantly connected with the central office.

"Cole calling from key station number four. Looks bad. Dew point is still around twenty-five. There's some wind due from the north, but it won't be here before dawn. It looks like a whole night of it."

Smith turns to the operators around the table.

"It's everybody out



Top, Paul Smith at "nerve center" of modern Paul Reveres, where two dozen telephones speed frost warnings to citrus growers. Below, taking one of thousands of nightly thermometer readings, and an avenue of flaming smudge pots



again tonight," he says. "And the cold won't break until morning."

The buzzers sound even faster now. There are no longer cheery remarks to the men called from their beds. There is no time for that. Two thousand growers must be contacted, and no call must be delayed when the mercury is falling to the point which means ruin and poverty.

The riders speed through the groves. The tocsins from that office go out unceasingly. The hours drag on. The temperature falls. The dew point is unchanged. If the dew point rises, the



frost danger is less, for when dew forms, heat is released and the temperature decline is retarded. But when the dew point is below the frost point, the release of heat comes too late.

Coffee is served to the group around the table. They reach for the cups without looking away from the lists before them. Out in the groves women are serving coffee to men whose faces are

(Continued to page 132A)

High-Wing Transport Plane Has Visibility for Sightseers



Windows of air liner below its high wing give passengers an unobstructed view of ground, and tricycle gear keeps plane on level keel when it lands

Affording better visibility for sightseeing, a high-wing airplane announced by Douglas carries sixteen passengers. It is equipped with the tricycle landing gear, adapted from its bigger brother, the "DC-4." With a strong keel along the bottom of the ship, it can land without its wheels in an emergency with safety. It is sixty feet long and has a wingspread of seventy-eight feet. On two 850-horsepower engines, the "DC-5" can cruise 169 miles an hour.

Radios for Power-Line Trucks

Speed Up Trouble Shooting

Short-wave radio is helping trouble shooters, those minutemen of the power lines, to speed up answers to emergency calls. One power company is operating thirty-five trucks equipped with radio sets receiving orders sent over a 150-watt transmitter. Another company uses a fifty-watt transmitter to contact trucks and cars. As soon as an emergency is reported to the service station a dispatcher notifies the truck closest to the trouble and instructs the crew to proceed to the scene. Two supervisors' cars also have transmitters, and in case of serious breakdown, the super-

refer to publicity sect.

visor answering the call reports progress being made and also orders any additional equipment needed. The extension of short-wave radio to trouble shooters is possible under the recent allocation of ultra-high frequencies by the Federal Communications commission to organizations established for relief purposes, persons in remote locations, and public utilities.

Single-Runner Sled Adds Ski Thrills to Coasting

More speed and greater thrills are possible with a sled riding on a single ski instead of the usual double runners. It is steered by rolling the body to the left or right. Rails on the sides of the platform give the rider constant control. Weighing only fourteen pounds, the sled is easily handled.



Hand rails give a strong safety grip for balancing the single-runner sled on a fast ride downhill

single-runner sled on a fast ride downhill

Plants Grown without Sun or Soil Test Light

Mysteries of the effect of light on plant growth are being unraveled by "incubator tomatoes" raised from seeds without sun or soil. In the experiments, which are being conducted at Smithsonian Institution, chemically treated solutions and artificial light take the place of soil and sun to "pick to pieces" that which we know as light. The plants are submitted to tests under lights rich in different colors, some red, some blue, and so on.

14446

Fume Detector Sees Shadow Cast by Poison Vapor

So sensitive that it can "see" one part of mercury vapor in one billion parts of air, a fume detector just developed reacts instantly to the "shadow" of the poisonous vapor. Mercury emits a blue and ultraviolet light. A lamp in the detector emits these same rays, and when samples of air being tested are sucked into the unit, any mercury vapor in the air will absorb the light and cast a shadow on a photoelectric tube. Since the amount of mercury in the air is proportional to the shadow, the apparatus can measure the vapor.

14478

Soft Metal Frames Bind Miniature Film for Projection on Screen



Tape and adhesives are eliminated in the use of soft metal frames for binding thirty-five-millimeter negatives for projection. The film is simply sandwiched between the two glass plates and the aluminum edges of the frame are folded over with the fingers. These frames can be used repeatedly to bind other negatives, folding again and again without cracking the metal.

Minora American Corp



Top, lighting a 500-watt lamp in an apparatus that gives various intensities for the growing plants; bottom, examining some tomato plants



Chemical Electric Co. Solomonsky, My

Mr. Carl S. Johnson.
Dimension of Radiation
and Organisms

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Military flying is far more hazardous than civil aeronautics but accidents are surprisingly few in view of the tremendous number of hours that pilots spend in the

WITH one sharp look at the plane settling for a landing the dispatcher in the airdrome's control tower hastily reached for his radio phone.

"Johnson in BC-1! Get your wheels down! Your wheels are up! Get your wheels down before landing!"

The oncoming plane faltered and then zoomed upward as the voice of its pilot came in over the loud speaker. "The wheel gear must be stuck. It's wound down and the indicator shows the wheels are down. I'll try it again a couple of times. Check me as I fly over the tower."

Watching, the dispatcher saw the wheels finally unfold from the wing and lock in position. Then he cleared the plane for its landing. From his position high above the military airport the vigilant

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Stevens
County Calif

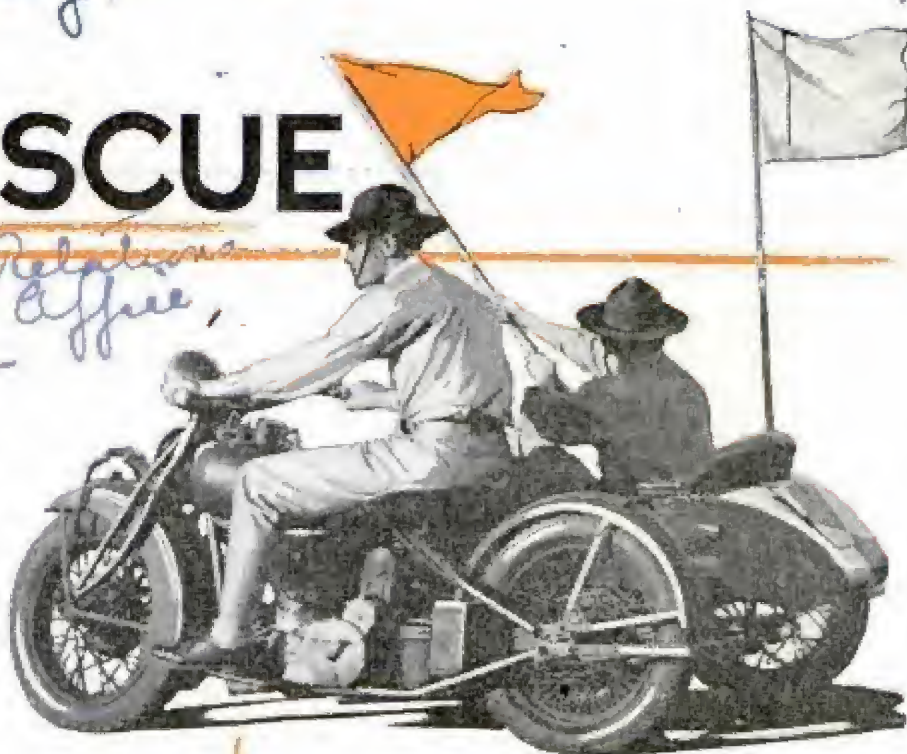
Nov 11 1937

to the RESCUE

Public Relations
Office

air. At such an airdrome as March Field in California where bombers, observation planes, and attack planes engage in daily maneuvers there are several hundred flights every day with the total sometimes rising to 600 take-offs and landings in twenty-four hours.

Often as not when an accident happens at the field the towerman sees it coming. If it is at a far corner of the great airport he will be on the phone, ringing for the "crash wagon" and ambulance to get out to the scene, even before the plane hits the ground. That's because the men on tower duty, used to judging landing speeds and angles, can sense something wrong before a crash takes place. If a plane loses flying speed too high above the landing mat and its wings start to wobble, there is not



Directing bombing plane to parking place. Bottom of page, crash crew member in "hot papa" suit demonstrating use of spear for ripping away skin of plane fuselage to rescue fliers

much chance that the pilot will be able to pull out safely.

Even if the pilot is uninjured he barely has time to unsnap his safety belt before the crash wagon slides to a stop beside the wreck. Equipped with every kind of fire-fighting device and with emergency tools





Left, "hot papa" holding carbon-dioxide thrower for quenching flames. Below, attaching disabled plane to truck before hauling the ship off the field

for smashing into closed cockpits, the red eighty-five-mile per hour truck stands parked at the side of the field night and day. Its crew of two trained men may do nothing for weeks except keep the engine hot for instant starting and an eagle eye on the planes maneuvering around the field, or they may respond to several crashes in one day.

The worst kind of crash is one with a fire and with an injured man inside the plane. Then one of the crash crew pulls on the "hot papa" suit, asbestos clothing inside of which he can walk through the hottest gasoline flames to rescue a disabled flier. Flares and ammunition inside the plane are apt to explode from the heat yet rescue work must be done calmly. There is no time to waste fumbling with a jammed cockpit cowl and the rescue man may rush in on the plane, rip the dural sheathing away with a special lance, and fight his way to the pilot. A burning plane is fought down-wind, a blanket of freezing carbon dioxide being laid down first, followed by foamite solution to prevent a flashback.

Once an observation plane was getting up to flying speed on the take-off when one of its landing flares broke loose and caught in the tail skid. On fire, the fiercely burning flare enveloped the tail group in flames. The pilot knew that the fire would spread forward as soon as he slowed down, yet it would be suicide for him to take off. Using the brakes as hard as he dared, he slowed to a stop. By then the flames were eating forward and he barely had time to jump away. The crash wagon arrived just as he hit the ground and the crash

crew saved the motor, lower wings, and fuel supply.

The gasoline supply does not always catch afire in a crash. When an attack plane turned over because





its wheels locked as it was landing, streams of gasoline started pouring down the sides of the plane and one of the crash crew was saturated with the fuel as he tore away at the cowlings to rescue the men inside. Fire might have started any second and the other crash man stood by with the carbon-dioxide thrower in his hands, ready to smother the first leap of flames.

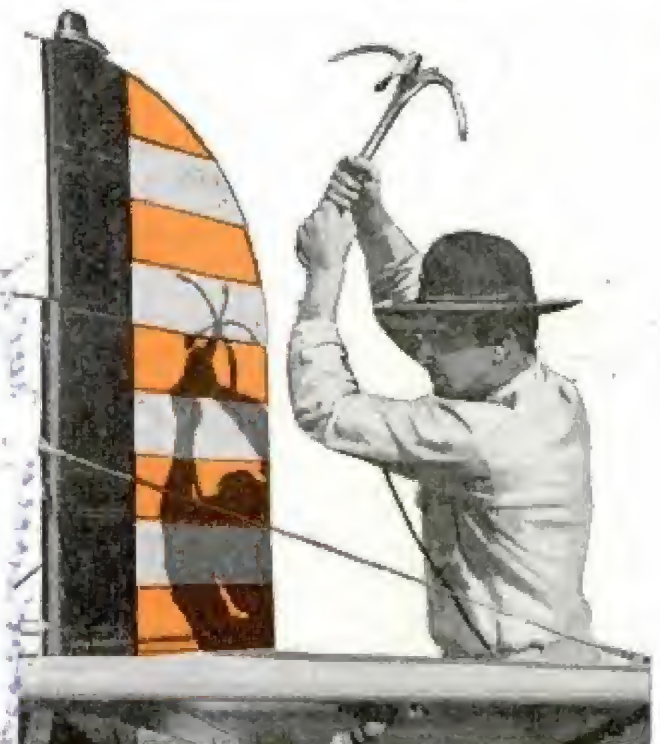
Many bad crashes happen away from the field in mountainous areas where there are no landing places. If engine failure disables a plane its crew may have to jump for their lives. Right now there are a number of wrecked military planes high in the mountains, too far from trails or roads to be salvaged. All that the salvage crew can do in such a case is to rescue the machine guns and ammunition and then completely hide the wreck with brush so that it won't be sighted from the air and reported as another crash.

March Field's ponderous six-wheel-drive salvage truck can be driven into surprisingly difficult spots to salvage a plane or repair it so that it can fly again. On one trip the truck may be driven into Utah and then across twenty miles or more of open desert to reach the scene of a forced landing. Another time the truck may be able to crawl to within half a mile of a wreck high in the Sierra Nevada mountains. Trees are cut down to open a pathway and then the plane is hauled down over the snowbanks to the truck with a long block and tackle.

When his motor conked out too far from

an airport one pilot made a perfect landing in a city dump. He got down all right but he couldn't get up again and the salvage truck made a 100-mile trip to the spot to remove the wings and tow the fuselage out to a field large enough for a take-off. Another time two fliers lost in a snowstorm at night thought they spotted an emergency field alongside an airways beacon and they landed in what turned out to

(Continued to page 126A)



Top, crash wagon ready for rescue work. Bottom, grapple hook that may be slammed into airplane wing or tail when plane must be moved quickly in emergency. A truck hooked to the grapple can drag the plane away, thus aiding in rescue of the fliers.

Bowling and Golf Joined to Make Indoor Game

Bowl. Golf.



Making long putt on carpeted alley of new bowl-golf game, with head pin instead of a cup as target

Golf clubs swing all winter on green-carpeted bowling alleys in a recently introduced game in which the golf ball replaces the bowling ball, and featherweight pins are toppled by accurate putts. Scores are made the same as in bowling.

Radio "Ear" for Blind Flying Tells Pilot His Position

With the newly developed "marker receiver" installed in his cockpit, an air pilot is given a tone or visual signal that tells him his position over one of the beacon stations on his route. The signal is automatic, and in effect creates a trail of radio "landmarks" that orient the pilot when flying blind. These beacon stations transmit "marker" signals in fan or cone-shaped pattern directly overhead, on a frequency of seventy-five million cycles per second.

As the plane carrying a marker receiver enters the field of this pattern, the receiver emits a characteristic tone identifying the station below. It is also equipped to operate lamp signals in the cockpit.

Light for Electric Shaver Attaches to Any Make

Headlights for electric razors are the latest convenience for the man in the family. A small electric lamp that "rides" the shaver



throws a bright beam of light just where it is needed, directly in the path of the cutting head. The lamp plugs in between the shaver and its connecting cord.

Two-Hundred-Pound Wrench Turns Huge Hinge Nut

When a machinist is called to tighten one of the big hinge nuts for Chicago's new lock gates, he takes along a giant end wrench weighing about 200 pounds. The lock, in appearance resembling a canal



A wrench taller than himself presents a problem to the workman who moves it from one job to another

jutting out into a harbor in Lake Michigan, is being built to control diversion of water from the lake into the Chicago river, and will also seal the harbor so the river does not reverse after a storm and pollute the city's source of drinking water.

Barrow Inside Giant Wheel Carries Large Loads Easily



Hauling heavy load in barrow as it rolls easily on the inside track of big wheel. The barrow always remains right side up

Eye Tester for Auto Headlights Runs on a Trestle

Automobiles must have good "eyes," and to make certain the new cars go out with efficient headlights one car manufacturer uses an optical test system. The tester is mounted on a 100-foot trestle operated by pull chains. Rays of the headlights of each new car are focused through a condenser lens upon individual screens bearing an "x" for centering the light.

Rolling on the inside rim as a giant easy-rolling wheel turns, a container capable of carrying big loads forms a new kind of wheelbarrow. The container always stays right side up. Handles attached to the barrow make the vehicle easy to operate, one man being able to push it fully loaded.



Pulling the optical tester on its hundred-foot trestle into position for focusing car headlights

Clamps for Carpenter's Horse Hold without Nailing

Nails are not needed to assemble two-by-fours into a sawhorse if the carpenter is equipped with a clamp just introduced. After being cut to proper length, the up-rights are simply placed in the clamp. The cross-piece is added to complete the assembly by adjusting a bolt, and the horse may be dismantled quickly when the job is finished. Teeth in the clamp jaws insure a tight grip.



Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

GROOMING

By
Roderick M. Grant

INTO the Chicago terminal glides the stainless steel Aeolus, dusty and panting from its 441-mile sprint from the Twin Cities at an average of sixty-six miles an hour. A long haul and a fast one for any iron horse.

The engineer leans from the cab to get his orders.

"Take her out to the yards for a quick turn," he is told. "She is pulling the 'Zephyr' on a test run to Denver tonight."

One hour to clean the firebox, take on fuel, water, sand. A quick inspection. Then back to the Union Station and off for Denver at a mile a

Left, shoveling cinders from under the stack at the end of a night's run. Below, shaking and raking the firebox clean



the IRON HORSE



Just in from Minneapolis, No. 5624 submits to thorough inspection by electricians and mechanics in Chicago yard while fire is "pulled." Note ash buckets in adjoining track

minute. Nine hundred sixty minutes to go 1,039 miles. Minneapolis to Chicago to Denver, 1,480 miles with one hour's rest.

Ten years ago they'd have told you it was impossible. No steam engine could do it. Why, it took two or three changes of engines between Chicago and Denver.

Well, the Aeolus did it. How? The foreman of the roundhouse in Chicago's Burlington railroad yards explains:

"They could have done it years ago. They just didn't have the nerve. The steam locomotive has always had plenty of speed and power. But I'll tell you what keeps it pounding the rails on longer runs today—roller bearings and packed lubrication."

The old picture of the grimy engineer poking the two-foot spout of an oilcan into the elbows of his engine is now obsolete. They don't do it that way. The streamline

Aeolus, much the same old horse under its stainless-steel shrouding, could go 1,475 miles without seeing an oilcan. But don't think for a minute that locomotives ramble along day after day with no more than a trip to the coal chute and water tower and an occasional dumping of the ashpan. There's a daily ritual of inspection and testing and cleaning that involves hundreds of operations.

Any ordinary horse could expect a night's rest after a day on the milk-wagon route. But not the iron horse. From the moment No. 5624 eases under the coal tower in the Western avenue yard at Chicago after her overnight trip from Minneapolis until she emerges sleek and snorting under a 250-pound head of steam to start the north-bound run with the nineteen cars of the North Coast Limited, there's never a pause.



"Heavy" repairs occasionally include torch work on the stoker screw, which delivers coal from tender to locomotive firebox

No. 5624 is last in the morning parade to the Burlington railroad's roundhouse. At the water tower the engineer clammers down, takes a final look around for parts needing repairs and makes out his report of engine condition while the hostler takes over the locomotive. From the engineer's report and subsequent findings of engine inspectors, the roundhouse foreman determines what repairs are needed beyond the regular daily regimen.

Down the inspection track the procession moves like cars on a production line. No. 4002 of the "Blackhawk," in from the early trip from Minneapolis; No. 3001, the "Fast Mail"; No. 3012, which brought the "Ak-Sar-Ben" from Omaha; No. 7016 of the "Empire Builder," from the Twin Cities, and finally No. 5624 of the North Coast Limited. The hostler fills the 18,000-gallon water tank in the tender, then moves her along to the next tower for sand and coal. Twenty-four tons of bituminous

stoker coal are carried, and the chute drops a bit of coarse coal at the last for hand-firing to start the fire.

A few yards down the track a lever on the side of the engine is thrown and the ashpan is dumped into huge buckets in the pit between the rails. Shaker and poker clean out every remnant of fire from the firebox and a hose flushes the pan and drenches the ashpit.

On down the line the washers take over. From spray guns carried over the shoulder they shoot a mixture of light oil and hot water and air under pressure, washing the grit and dust of the road from the engine, from stack to coupler. Meanwhile steam and water are blown from the bottom of the boiler, carrying out any sediment that may have settled. The amber headlight gets a good polishing, then the nose of the locomotive is swung open and any soot and cinders that have settled under the stack are shoveled out.

All spic and span, the engine ambles another few yards nearer the stable and submits to the thump test. The hostler levels off the rods on one side of the engine to "dead center"; on the other side an inspector holds a caliper at various points on the driving rod and crank arm to measure



Before entering roundhouse, entire locomotive is bathed with mixture of hot water, light oil and air shot from spray gun

the jump when the hostler, setting brakes hard, gives it a "thump" of steam. If the caliper shows more than $\frac{3}{16}$ -inch slack, there's shop work to be done. Today, for example, No. 5624 shows too much wear on the shoe that carries the main rod, and the inspector jots an order on the report to remove the shoe for tinning.

At last No. 5624 is ready for a rest. She glides down to the turntable and noses into her stall in the roundhouse. Here it is eleven o'clock, she had her last bite of coal before she pulled into the downtown depot, two hours ago; the fire has long since been dumped, yet she still has steam up. How long can she keep up a working head? Five



With the fire out but the temperature still 210 degrees, inspector takes a look inside firebox, top. Right, gantry crane empties ash bucket from track pit. Left, taking on a fresh supply of sand

hours, if not overworked. In cold weather, however, the pressure may drop too low for work within an hour and a half.

Now for "the works." An electrician tests dynamo, lights, everything electrical, and changes the tapes on which a continuous log of the engine's speed has been recorded. A boiler washer blows her down, and inspectors go over every valve and connection for steam leaks, they inspect the gauge cock and water glass and clean them out, they dive into the pit to make any necessary repairs from below. Ham-

(Continued to page 130A)

Refrigerator Used as Oven for Heat-Treatment Tests



Using an electric refrigerator for an oven in putting electric coils and insulation to heat tests

If a refrigerator keeps heat out, it should also keep heat in. On that basis several discontinued models of electric refrigerators have been converted into automatic temperature-regulating ovens in the Westinghouse Research Laboratories to test varnishes and insulating materials under high temperatures. Electric coils and windings are put in the "refrigerator ovens" for accelerated aging tests.

Cars Passing at Fifty Require 1,000 Feet and Ten Seconds

Average drivers need 1,000 feet of road distance and ten seconds in time to pass the car ahead, traveling at fifty miles per hour. At thirty miles, cars require from 450 to 650 feet. This was learned in tests made by Yale University scientists to determine proper sight distances which will help engineers in designing highways of the future. With cameras and a stop watch, passing cars were photographed to measure distances, and the time taken for pass-

ing was recorded. Tests included flying passes, where the vehicle traveled at constant speed throughout the maneuver, and accelerative passes, in which the passing driver started at the same speed as the vehicle ahead of him. Forced and voluntary returns to the right-hand side of the road also were checked.

Lead Foil Built into Toe of Shoe Aids in X-Ray Fitting

To assure accurate and comfortable fitting of shoes, an inventor has patented a method of building a small piece of lead foil into the shoe to cast a shadow in the X-ray fitting machine. The lead foil is placed across the toe of the shoe, and if the wearer's toes extend beyond the oblong shadow seen over the X-ray, the shoe is too short.



Automatic Home-Movie Titler Saves Time, Ends Splicing

Eliminating printed titles and the burdensome job of setting up individual letters and numerals, an automatic titling machine for amateur movie makers is on the market. It is capable of setting up three rows of letters of twelve characters each. Thirty-six small wheels, each operating a



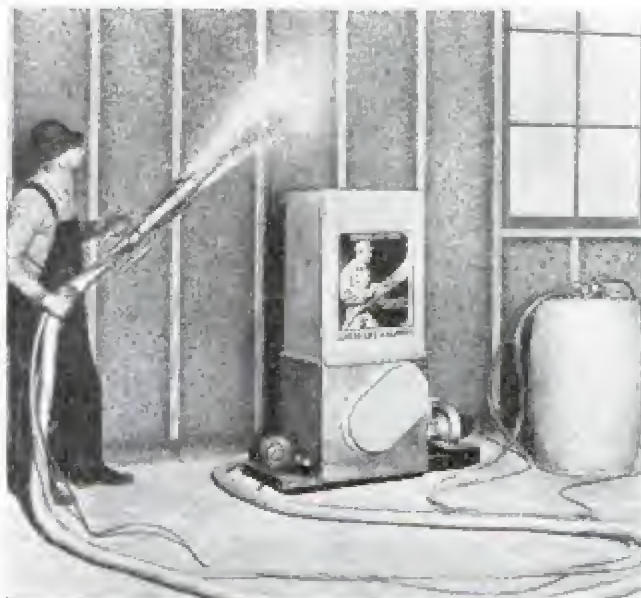
Title, shown inset, as written by automatic machine useful to home movie makers

Universal Camera Corp.

ribbon of forty-two characters, afford a total of 1,512 letters that fall into place automatically at the touch of the finger. On each ribbon a complete alphabet, numbers from zero to nine and all punctuation marks, stand out in brilliant white against a dead-black background. The titler is pocket size and can be used with any make of movie camera, eight or sixteen millimeter machines. Important also is the fact that the usual splicing and film rearranging are eliminated, since the movie maker, having finished shooting a scene, sets up an appropriate title on the spot, photographs it by holding the camera in one hand and the automatic titler in the other. The title is recorded at once in its proper position in the film.

Insulation Is Sprayed on Wall Like Paint

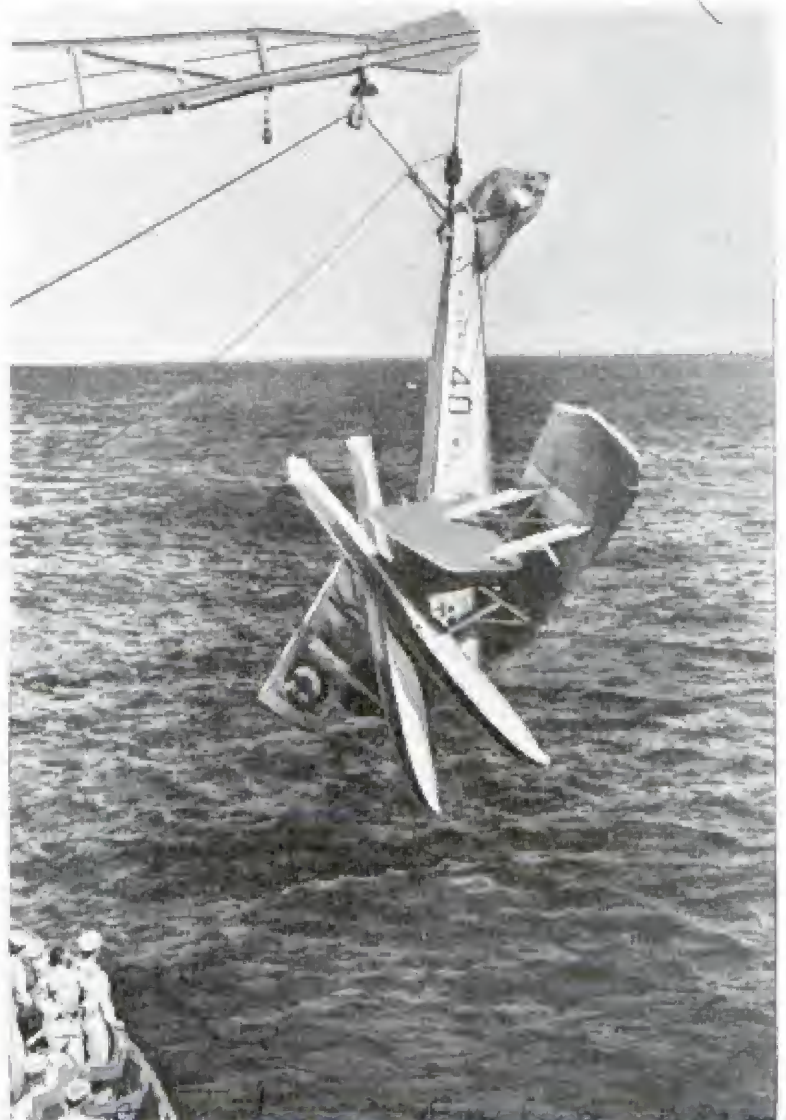
Sprayed on like paint, a new insulating material builds a "blanket" on the wall to give protection against cold or heat. Made in dry flake form, which is fire-proof, the insulation unites with an atomized adhesive as it leaves the spray gun. It can be applied to any surface such as wood, metal or concrete, in any thickness.



Spraying insulating material with special gun. Atomized adhesive holds it on the wall

Sprays. Flake Co. 1 Road

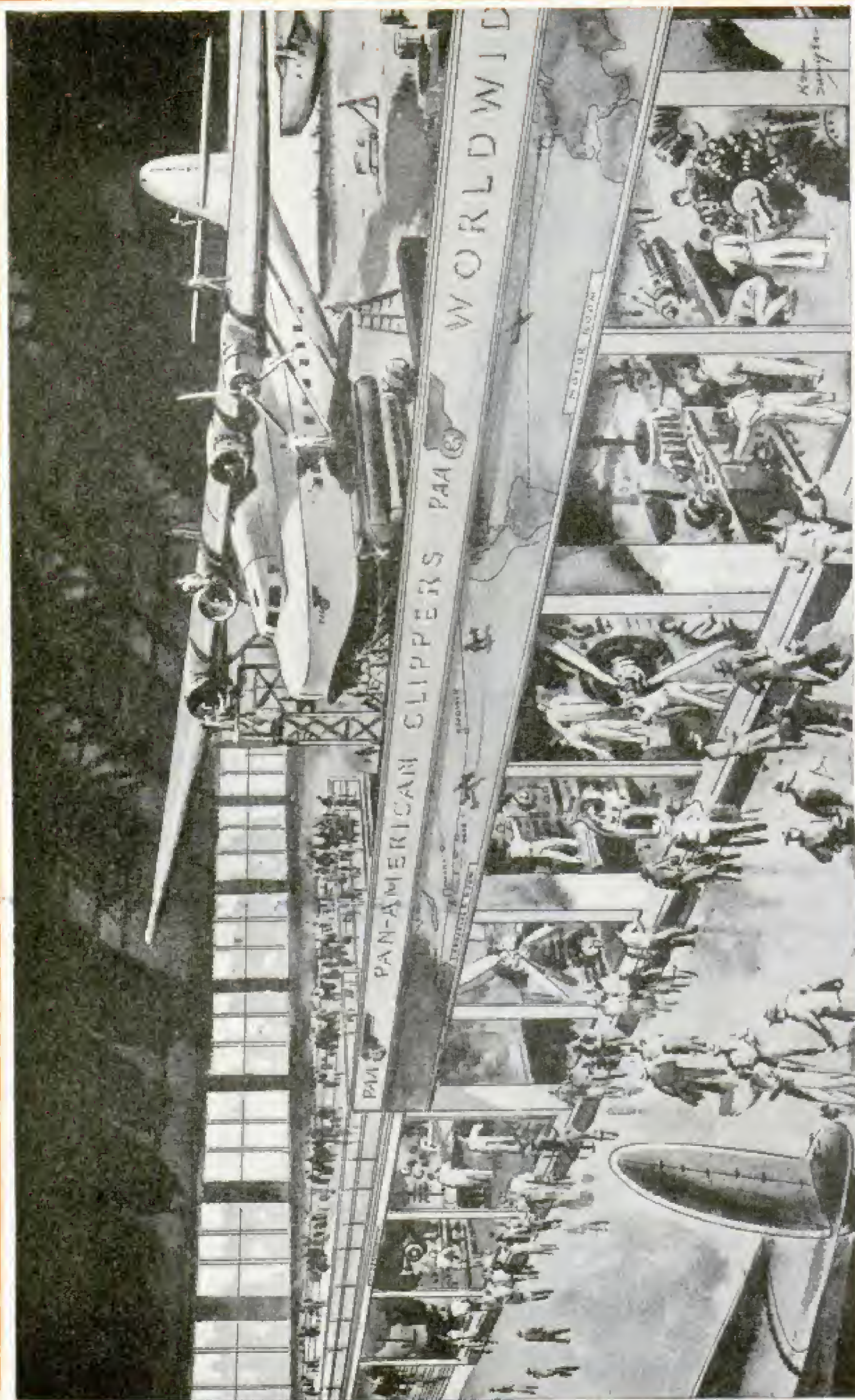
Target Planes Saved from Sea When Hit by Navy Gunners



With wings and pontoons twisted by crashing into the water, target plane is saved from a watery grave by rescue ship

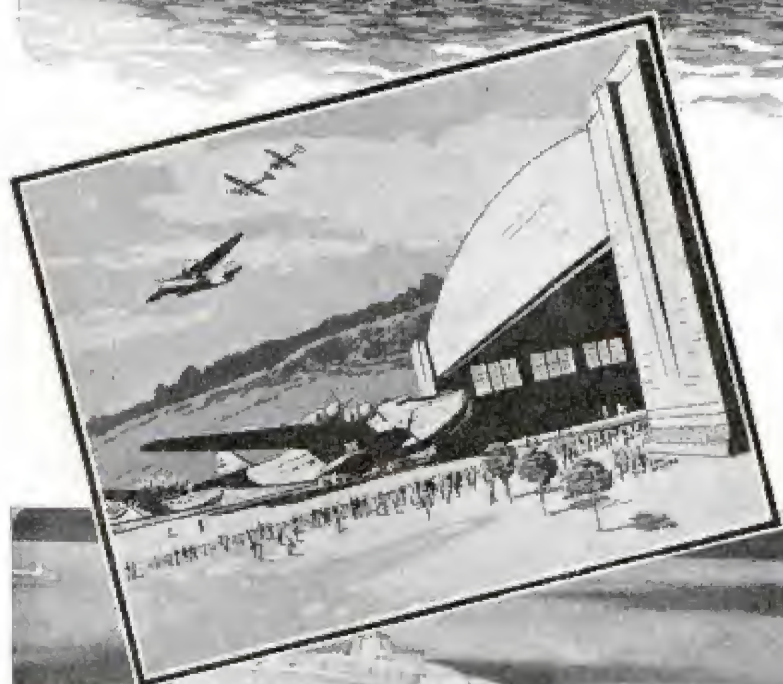
Small seaplanes, called "queen bees" by the British Royal Air Force, are used as targets for anti-aircraft gunners of the British navy. They carry no pilots, being catapulted from the "mother" ship and controlled by wireless when in the air. Their motions, simulating actual conditions of an air attack, make them ideal for gun practice. Since the target plane carries costly wireless equipment and motors, a rescue ship is always ready to pick it up when it is brought down.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.



Here is how the "air line under glass" will appear to the visitors at the Golden Gate Exposition on San Francisco bay. Clipper planes will land and take off in the lee of Treasure Island and receive overhauls in this Hall of Air Transportation. Spectators will view all operations through glass panels, as shown here

AIR LINE *under* GLASS



Above, Philippine clipper taxiing off Treasure Island against a background of Golden Gate Exposition buildings. Clipper ships of Pan American Airways will base here during the exposition. Left, Hall of Air Transportation where Pan American will put its entire trans-pacific air base under glass. This drawing shows a clipper being hauled out of the water on a cradle for its overhaul in the building



Treasure Island, San Francisco's municipal airport, as it will appear after Golden Gate Exposition is over. Pan American will base its clippers on the island

Windmill Goes for 'Swing' but It's a Camera Trick



Bending the enlarging paper during exposure produced this "windy" picture of a New Jersey windmill

Looks like a stiff wind blowing over this New Jersey farm, doesn't it? But this isn't one of those hurricane pictures. It was a nice day, and the backbone of that windmill was perfectly straight. The trick is done in the photographer's darkroom, simply by holding the enlarging paper in a curved position while exposing it.

Safety Overshoes on Auto Tires Are Removed in Spring

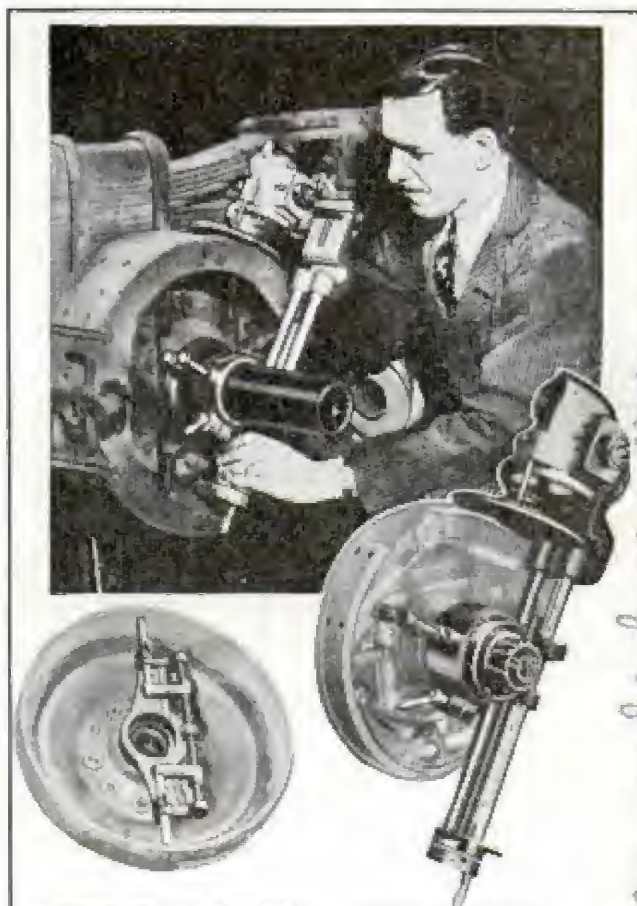


Like many folks, automobile tires are wearing overshoes for safety in winter. When spring comes, these encumbrances are unwanted and unnecessary. The overshoes are not slipped over tires,

but are built into the treads. They consist of hundreds of deep, sharp, rubber winter-traction lugs which provide safe driving by gripping into slush and snow just as a tractor does. In the spring, the tires are taken to the dealer, who buffs off the lugs, leaving a brand new tread that has never touched the ground. This new tread, however, is not intended to replace the cleated-type of passenger-car tire for regular driving on soft, unpaved roads.

Brake Gauge "Tailors" Drum and Shoe to Exact Size

Brake-drum gauge, shoe gauge and grinder are combined in a precision tool just introduced to the garage trade. Operating on direct or alternating current, it tailors the lining to the exact drum size while the brake shoes are in position on the car. Its micrometer gauge checks the wear on different parts of the brake and permits adjustments directly on the axle. The drum micrometer, calibrated in thousandths of an inch, first takes its reading and then is transferred to the grinding unit, locked to the correct size.

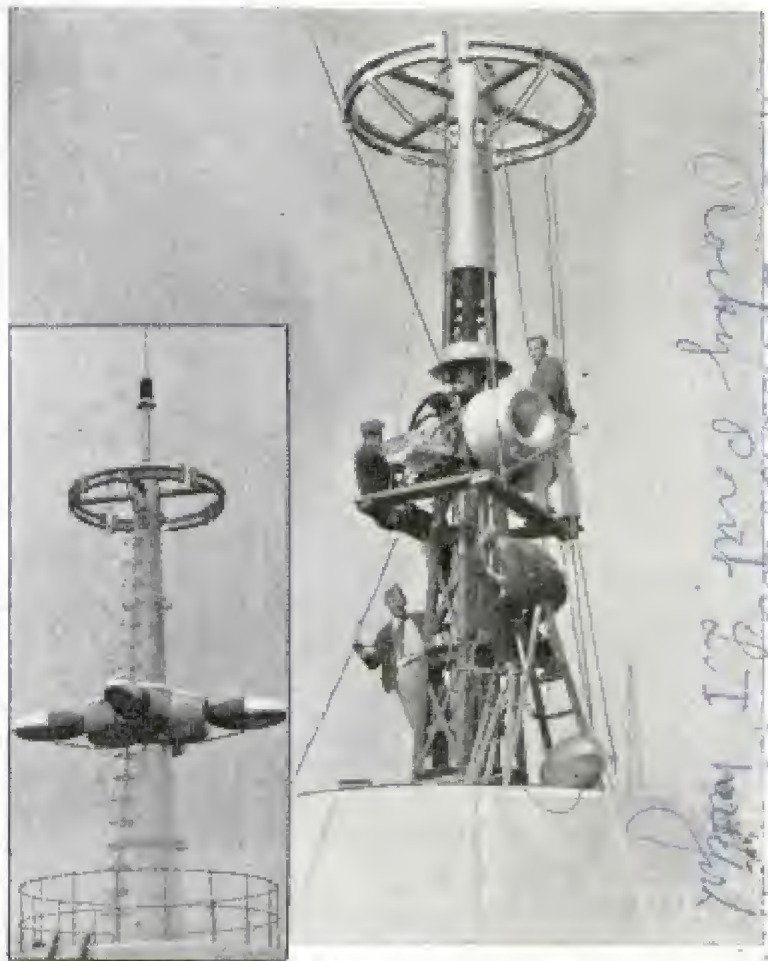


Measuring brake drum, below, and grinding to exact size with the combination gauge and grinder

Stiles-Barrett Corp.

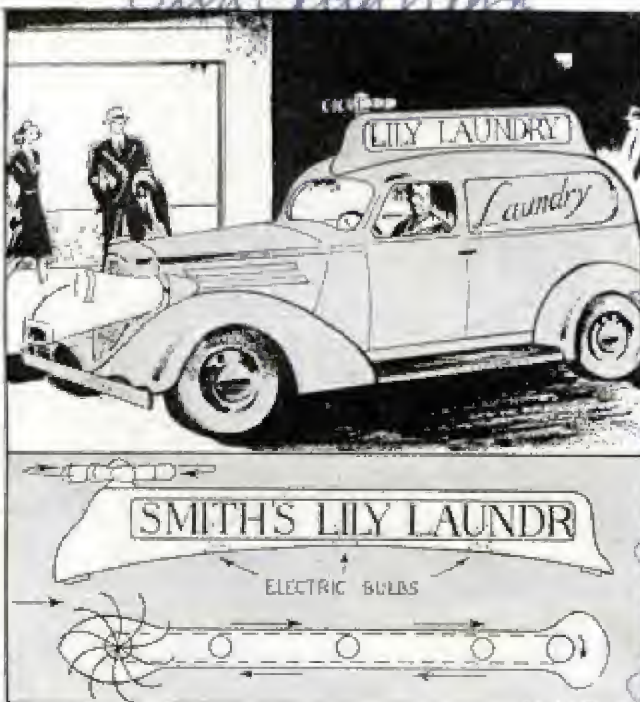
Torpedo Antenna "Sprays" Television Picture

From a unique dual antenna atop the Empire State building, 1,200 feet above the streets of New York, go pictures and sound to the television audience of the metropolitan area. The scenes are "sprayed" from torpedo-like objects pointing in four directions; words and music emanate from a newly designed type of doublet which doubles back on itself, four together forming a loop above the torpedo antennas. This equipment was engineered to fill the need for antennas capable of transmitting television signals "flat," or without peaks, over a thirty-megacycle band. Actually it can accommodate six times the band width necessary for present television standards. Its electrical measurements as precise as the specifications of a fine watch, the torpedo-and-loop antenna must withstand the rigors of weather on its high perch, and the installation includes both a lightning rod and heating units to prevent ice formation.



Installing television antenna on Empire State building, and finished unit. Sound radiates from loop, pictures from "torpedoes"

Lighted Motion Sign on Automobile Uses Wind Power



Moving sign mounted on auto and two views showing the three lights and how air-wheel turns the belt

Kept in motion by an air-wheel operated by the wind, an illuminated sign has been developed for use on the top of delivery vehicles. The sign is painted on an endless strip of translucent celluloid about eight inches wide, and is carried on two vertical rollers about two inches in diameter. An air-wheel twelve inches across catches the slightest breeze and converts it into rotary motion to drive the forward roller. Thus an ever changing message is presented on either side of the automobile. Three electric lights in the base of the sign, placed between opposite sides of the endless belt, give all the illumination needed both night and day. All moving parts have anti-friction bearings.

⚡ If all the energy in a gallon of gasoline were converted into work it could lift a 460-million-pound building two and one-half inches.

Developed by Research group working
H. E. Hendricks, R. E. G. Johnson
Rocky Point, N. I. Westinghouse

Used same principle

A. V. A. McHarg

Is m.c. Chemistry
and wheels

"Crank-and-Pedal" Tricycle Has Standing Room Only



Treading on pedal boards drives this unique tricycle, and there is an extra pull in hand-turned crank

You ride standing up on the novel three-wheeled vehicle invented by a Statesville, N. C., man. Either foot or hand power, or both, can be used to propel this tricycle. As the rider shifts his weight from one pedal board to the other, a ratchet attached to the single front wheel pulls the wheel over. Meanwhile the other pedal is allowed to rise, and a spring winds the opposite ratchet back on the wheel. There is reserve power in the hand-turned sprocket connected by chain to the front wheel.

Electric Lunch Box for Worker Heats in Fifteen Minutes



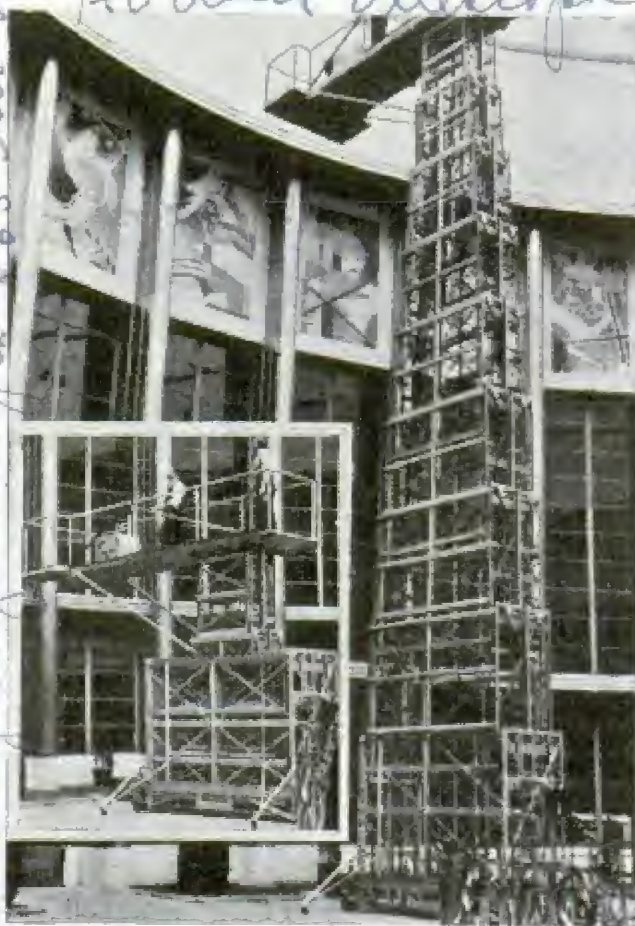
In a thermostatically controlled electric lunch box a workman can carry a full meal to be heated at noon by plugging in on any convenient circuit. It takes about fifteen minutes

to warm up a complete luncheon. The top unit has three removable aluminum cups

for food. The bottom unit, which is not heated and is insulated from the upper section, can be used for food and utensils. There are optional heating elements for 110-volt, twelve-volt and six-volt circuits, and chemical heat is also available.

Electric Jack-in-Box Platform Lifts Workmen into Dome

Maintenance and repair work on the lofty Rotunda of the Ford Motor company, at Dearborn, Mich., posed a difficult problem which has been solved by a "jack-in-the-box" platform for workmen. The telescoping platform, consisting of eight aluminum frames, rises by electric power from a base height of eight feet nine inches to a top forty-six feet above the floor. The motor, mounted at the base, is controlled by push buttons on the railing of the working stage, which extends outward to give easy access to the murals and electric lights around the wall. Originally the Ford building at Chicago's Century of Progress Exposition, the Rotunda was moved to its present permanent location.



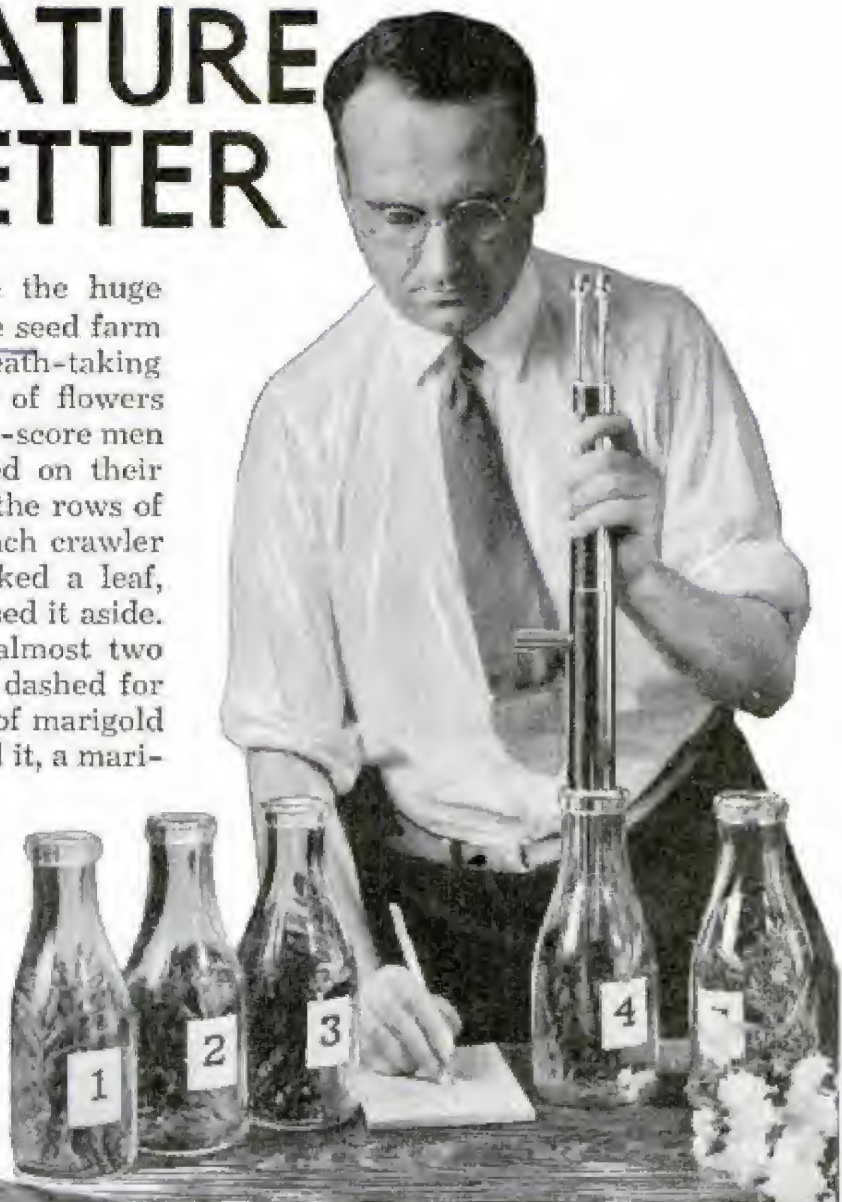
Electric platform extended to full height for cleaning Ford Rotunda, and, inset, retracted into base

Going NATURE ONE BETTER

OUT in California, where the huge W. Atlee Burpee Floradale seed farm offers in midsummer the breath-taking spectacle of a thousand acres of flowers bursting into bloom at once, two-score men and women in overalls crawled on their hands and knees up and down the rows of forty acres of marigolds. As each crawler came to a new plant, he plucked a leaf, crushed it and sniffed, then tossed it aside.

These antics continued for almost two days, when one young worker dashed for the farmhouse, waving a sprig of marigold leaves and shouting, "I've found it, a marigold without odor."

The occasion goes down in seedmen's annals as the "great Burpee smelling bee." It was inspired by David Burpee, head of the seed house, whose ambition was to trick nature into originating a marigold without the rancid odor offen-



David Burpee, above, using osmoscope to detect faintest odor, if any, in foliage of marigolds. Bottom, experimental work with flowers involves hooding promising plants to prevent cross-pollination

El Monte, Calif.



Top, sweet peas almost shoulder high. Right, "Pinkie blood" strain of sweet pea compared with ordinary variety



sive to so many people. Mr. Burpee knew that if he could find one odorless marigold plant among the 600,000 on his farm, he could breed an entirely new strain. But he had to have the one plant, a sport or mutation, without the little white oil glands in the leaves. Only nature could give him that, and he knew that only once in 900,000 plants did nature throw a mutation. This explains the rejoicing when the odorless marigold was discovered. Before long, the joy was doubled. A missionary in the interior of China sent Mr. Burpee two dozen seeds of a new marigold he had discovered. It, too, was entirely odorless. Thus the hybridizers had two chances to rebuild the marigold, and in five years, they and breeders of four other flower seed farms, who availed themselves of the new stock, changed the marigold from a social outcast in the garden to a reigning favorite.

These two events, the finding of a mutation in a seedman's garden, and the discovery of the amateur seed hunter, illustrate two of three main methods by which science is constantly outwitting nature to improve flowers and vegetables. Na-

ture is careless, and the highly bred plants upon which we depend for color and fragrance or for food have a tendency to revert to type. It is a never-ending struggle to build them up. Until recently plant builders were dependent upon seed safaris for breeding stock with which to work. Within the last five years they have discovered new methods of "shocking" plants to change their chromosome set-up, thereby increasing the probability of mutations a thousandfold. Some of the tricks they play on nature read like magic.

For decades, seed hunters sought a nasturtium with a better smell. Finally, to his amazement, "Uncle John" Bodger, head of the Bodger seed farms, discovered a bouquet of double, yellow, sweet-scented nasturtiums on the table in his niece's home at El Monte, Calif. His niece said a Mexican woman had given them to her.

The Mexican woman said she had received the seeds from a friend who got them in a garden in a town in Mexico. Mr. Bodger caught the first train for the town. But



Muslin cages inclose calendula plants, the seed of which will be saved and grown for future inspection



the garden was neglected and all the plants had died. The family that grew the nasturtiums had moved away and no one knew where they had gone.

But in the meantime, another niece, Elizabeth Bodger, one of the out-



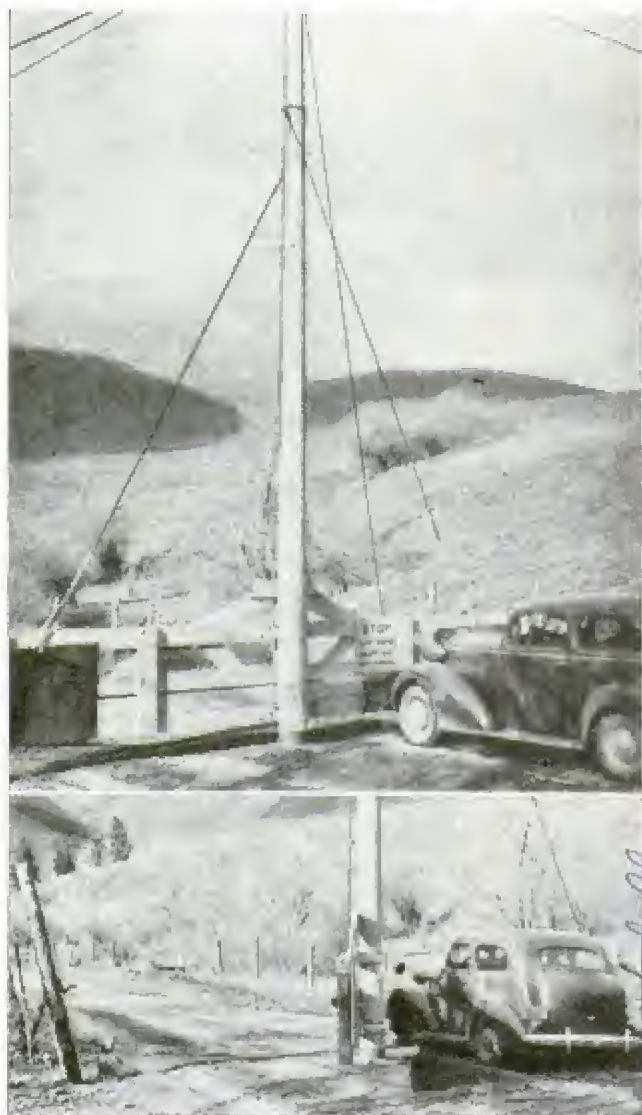
standing plant breeders of the country, had gathered a handful of seed of the double golden sweet-scented nasturtium in the Mexican woman's garden. From these the Bodgers grew the first "Golden Gleams," which later gave their doubleness and their sweet odor to nasturtiums of all colors.

The Bodgers and the Burpees are great rivals. When the Bodgers scooped the world on the first "Golden Glean" nasturtiums, the Burpees looked for ways to even the score. Before long their gar-

(Continued to page 118A)

Top, hand-pollinating giant petunias. Center, treating plants with chemical extract. Bottom, growing sweet peas for seed

Self-Closing Bumper Gates Swing on "Maypole"



Ranch gate swings open when nudged by car, then cables swing it shut by their own torque

Farmers in the stock-raising regions of the northwest are installing automobile gates that swing shut of their own weight after the car passes. A center post twenty-five to thirty-five feet high supports the gate. The motorist edges the bumper against the gate, nudges it open and the steel supporting cables wrap themselves around the post like ribbons on a maypole, and by their own torque pull the gate closed. The gate is built heavy enough to prevent farm animals from pushing it open.

Electric Fence Guards Cattle from Tick-Infested Deer

Eighty miles of electric fence erected in Florida helped cattle raisers win a skirmish with fever ticks and at the same time

Miller Rubber & High Pressure Hose Co.
Inc. - 12 + Jackson St.

saved the guilty deer "carriers" from slaughter. A recent check of cattle in one area freed of ticks by dipping and rigid quarantine, showed they had been re-infested, and investigation proved that wild deer were the smugglers. As a humane alternative to killing the deer, an electric fence was stretched from Bonita Springs on the Gulf of Mexico to the Everglades. Quarantine guards watch the gaps where roads cut through. One contact with the fence keeps a deer away from the area.

H 1493

Ribbed Hot-Water Bottle Fits Curved Surfaces

Three interior partitions running lengthwise permit wrapping a ribbed hot-water bottle around curved surfaces such as arms and shoulders. This type of construction prevents bulging and strengthens the bag. The bottle is twenty inches long.



H 1496

Steel Hook for Auto Repairman Straightens Fender or Body

Bent fenders and running boards, dented aprons and car bodies can be straightened with an adjustable metal hook just introduced. The hook is mounted on a shaft for lever action, both shaft and hook being of strong steel. Rubber cushions protect the finish of the automobile and provide a grip.



Applying leverage to steel hook to straighten car body. Notice the rubber cushions to protect finish

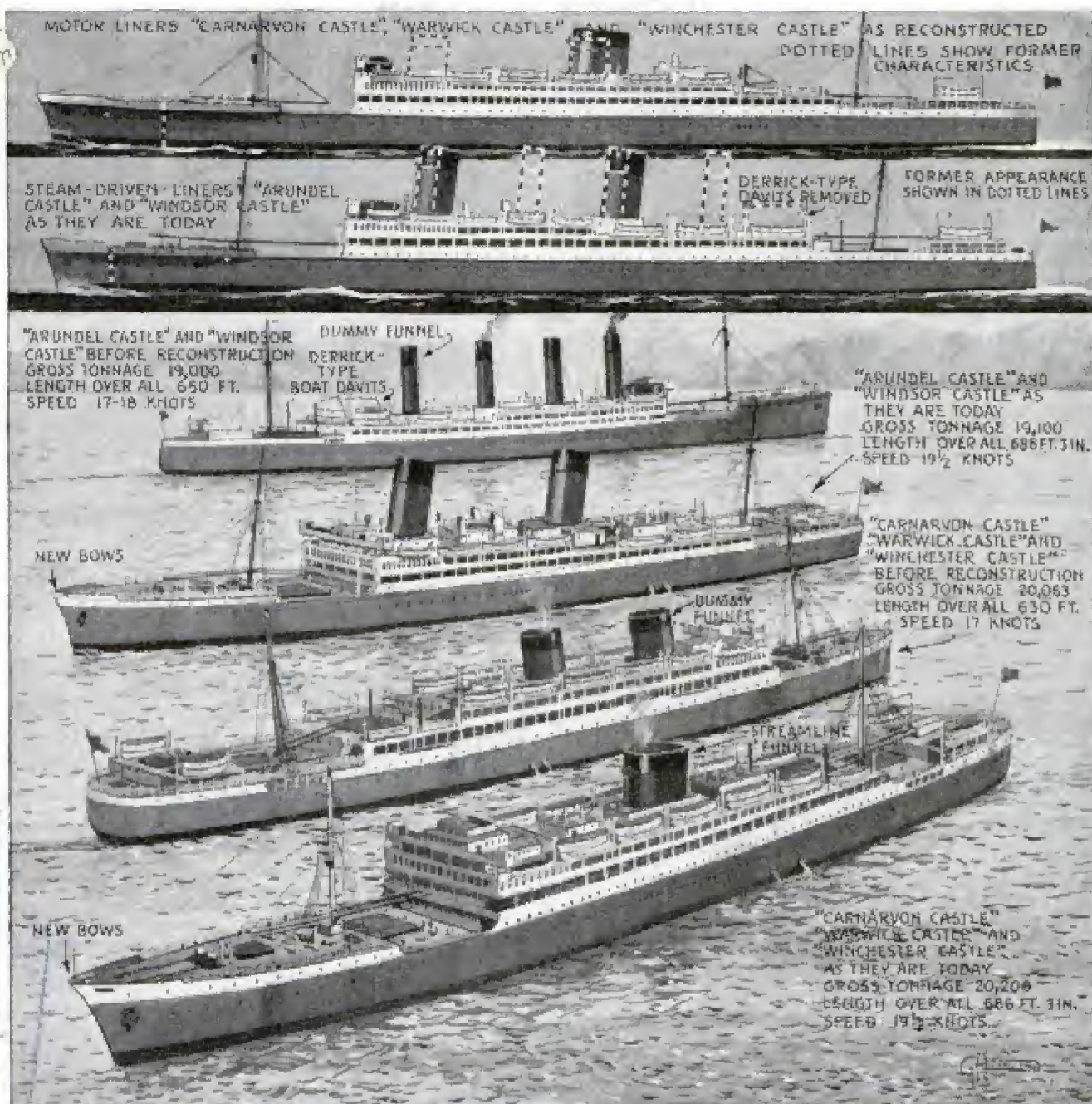
Cent. Kenneth W. Carlson

Rocky M. D. D. A. H. Strasser

141523

Cent. Milton B. Sackett

Old Ships Converted into Fast Ocean Liners



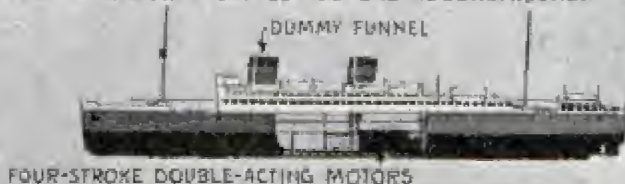
SECTION OF "ARUNDEL CASTLE" AND "WINDSOR CASTLE" BEFORE RECONSTRUCTION



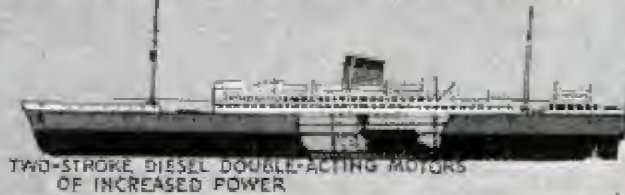
SECTION OF "ARUNDEL CASTLE" AND "WINDSOR CASTLE" AFTER RECONSTRUCTION



SECTION OF "CARNARVON CASTLE," "WARWICK CASTLE" AND "WINCHESTER CASTLE" BEFORE RECONSTRUCTION



SECTION OF "CARNARVON CASTLE," "WARWICK CASTLE" AND "WINCHESTER CASTLE" AFTER RECONSTRUCTION



To speed up ocean travel, an English shipping company has converted five old ships into fast liners. Two four-funnel steamships were lengthened and fitted with new engines and boilers. Three motorships were lengthened and equipped with the latest Diesel motors

Transparent Plastic Splint Is Used Many Times



Splint is molded quickly to fit curved surfaces of the arm, and holds broken member rigid upon cooling

Made of transparent plastic material, a surgical splint is shaped easily to fit the arm by dipping in hot water. It can be cleaned and reshaped by heating for repeated use. Light in weight, the splint is comfortable and the transparency permits taking X-ray pictures or examination of a wound without removing it.

Earth's Death in Fire Visioned in Latest Solar Theory

As the sun cools, the earth—many millions of years hence—ultimately will become a frozen orb as have other stellar bodies. But scientists now believe that death will first come to the earth in flames as it melts under a sun 100 times as bright and hot as it is today. This is the conclusion from the theory of Prof. Hans A. Bethe of Cornell University that carbon in the sun acts as a transmuting catalyst to

change hydrogen into helium atoms and thus release a tremendous store of nuclear energy that keeps the sun shining on and on through the ages. It is his belief that hydrogen in the sun is used up in the process, while the carbon content remains virtually unchanged. In studies of the evolution of stars, Prof. George Gamow of George Washington University found the main result of a constantly decreasing hydrogen content was to increase the luminosity of the stars and their output of energy. Professor Gamow estimates that the sun at present is about sixty per cent hydrogen, and that it will be 100 times brighter when its hydrogen content drops only a few per cent. However, any alarms over the imminence of the earth's end may be deferred for millions of years, for there has been no evidence of any climatic change due to increase in the sun's luminosity since the beginning of history.

Practice Golf Club "Breaks" If Player Swings Wrong

Improper swings are penalized by the bending of a "swing corrector" golf club. Just below the grip a spring breaks open if the player makes a false move in his drive. In this way each error is discovered and can be corrected.

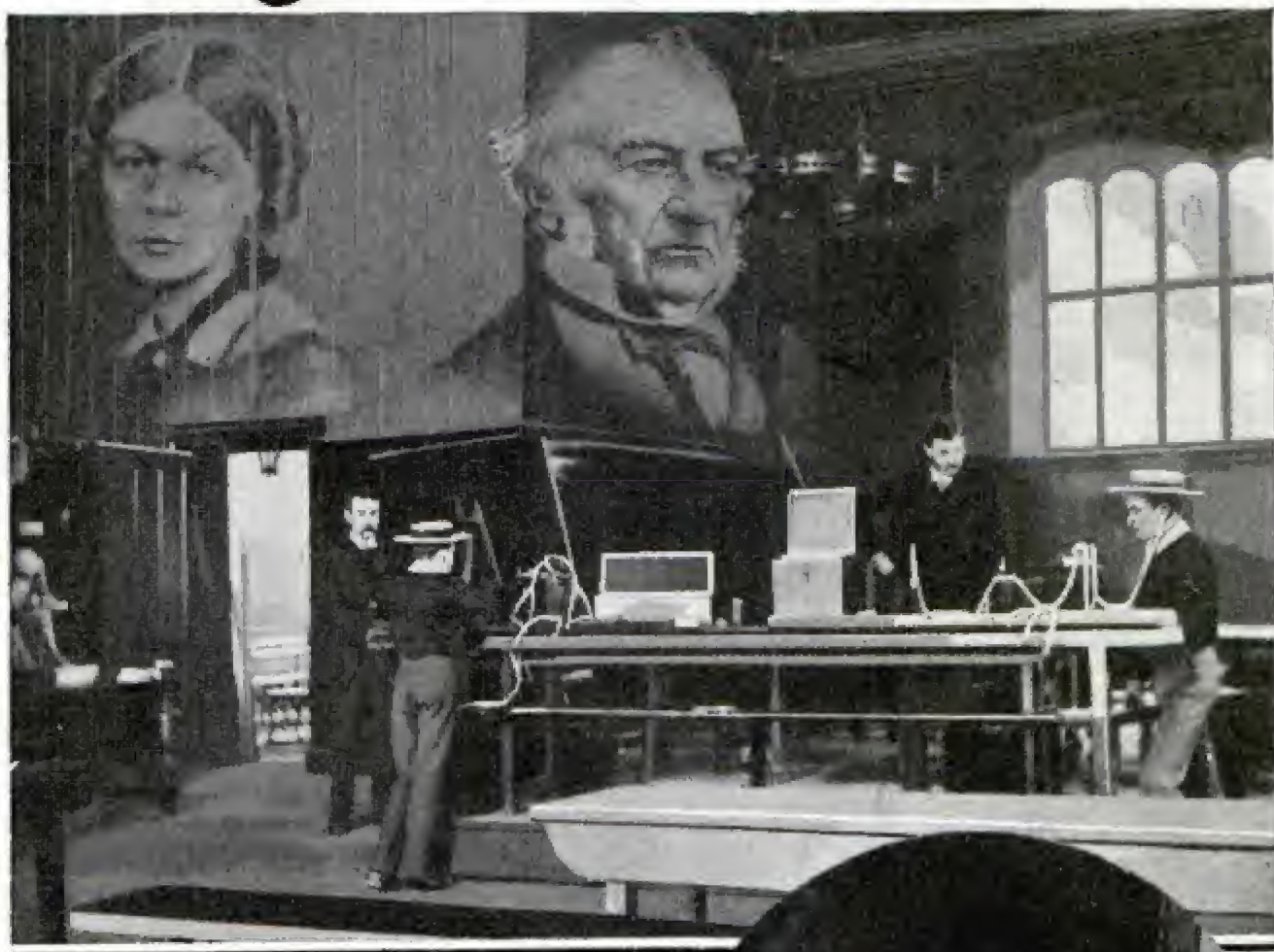


Arrow points to spring that breaks open to tell the golfer he has committed an error in his swing

John...
Club...
% Health Centre...

H. H. ... Contr. ... 1088. 66th St
New York City.

Hunting LOST VOICES



WHAT was there in the voice of Napoleon which inspired thousands of men to die for him on the field of battle? Was there something in the way George Washington spoke which gave the American colonists courage to continue their disheartening fight for independence? What about the voice of Lincoln and other famous men of an earlier day whose voices are now stilled forever? Did they speak with the calm assurance of President Roosevelt, the thundering impressiveness of Benito Mussolini or the hysterical earnestness of Adolph Hitler, present-day leaders who have stirred millions by their oratory?

Because of the importance which historians, educators and others are attaching to the human voice as indicative of the individual and the period during which he lived, scientists are preserving the voices of the modern great and near great for posterity and hunting for famous lost voices of



Top, London studio where voices of Gladstone and Florence Nightingale were recorded. Below, examining wax cylinders found by "voice hunters"



the past, some of which go as far back as 1878, the year Thomas Alva Edison invented the phonograph.

With the rapid development of perfect sound-recording on motion-picture film and phonograph records the voices of present-day leaders and statesmen are being preserved for all time. When the president of the United States speaks over a nation wide radio hook-up, every intonation and inflection of his voice is captured on a phonograph disk by sound engineers, perhaps hundreds of miles away, who simply set up their recording apparatus near the loud speaker of a receiving set. And when a famous statesman or celebrity is photographed "in sound" by the newsreel cameraman, his voice is recorded for posterity by technicians in a laboratory while the film is being projected.

Realizing the importance of the human voice as an aid to the printed word in recording history for future generations, the United States Library of Congress last year started its "voice archives," supplementing an earlier one

In taking off "lost voice" from fragile original record with aid of delicately cut sapphire, cylinder is played through amplifier to modern master disk, top. Center, record taken to R.C.A. laboratory is recorded on wax disk. Bottom, modern record on which voice is reproduced for posterity, and, right, Victor record just pressed and still retaining excess "dough" on edges



which Prof. George Hibbet of Columbia University began in 1926. But in listing the names of great men of the present and the immediate past, scientists pointed out that it was also possible to resurrect some of the voices of celebrities of the late nineteenth century, people who were still living in the early days of the phonograph.

Thus there is now under way a tedious search of world-wide proportions for the voices of some of the great who have passed on.

Leading this hunt is a sound engineer, scientist and former friend of Edison, Robert Vincent of New York, who has already ferreted out such famous voices as Premier Gladstone of England, Florence Nightingale, William Jennings Bryan, P. T. Barnum, Henry M. Stanley, the African explorer, and others. He has succeeded in



President Wilson's voice speaking from record to Indians. Below, os cillograph makes picture of voice

transferring their voices to modern phonograph disks.

Thus Mr. Vincent is carrying on one of Thomas Alva Edison's most cherished wishes. In 1878 when the great inventor patented the phonograph he said: "It will henceforth be possible to preserve for future generations the voices as well as the words of our Washingtons, our Lincolns and our Gladstones and to have them give us their greatest efforts in every town and hamlet in the country."

Mr. Vincent points out that in the early days of the phonograph it was not possible to make duplicates of phonograph records, as it is today, so that the crude wax recordings were the only ones in existence of the voices of the speakers. The wax cylinders were apt to crack and were very fragile. When Mr.

(Continued to page 143A)

40 Engineering Co. New York

Refrigerated Chest in Floor Lifts Out for Easy Access



Cold-storage locker is hoisted by overhead lift from refrigeration chamber into warm room for customer

To allow customers access to their refrigerated lockers without bundling up to enter a low-temperature room, the lockers are being installed under the floor and raised when needed. When a patron calls, the tier of lockers is hoisted by an overhead lift into a room at normal temperature, and it can be held at any desired distance above floor level. These lockers are made for use in meat, grocery and other stores where customers buy products in season and store them in six-cubic-foot refrigerated compartments until needed.

Pain Vanishes for Three Weeks under "Slow" Anesthetic

Slowing down the pace of a local anesthetic has resulted in killing pain for three weeks by one injection. The pain killer, a mixture of procaine, two other chemicals

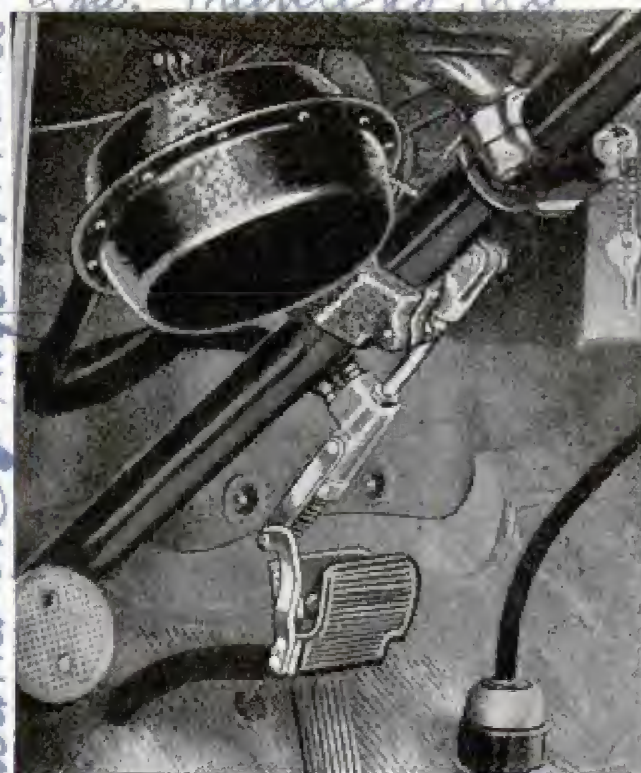
and refined French almond oil, is named neothesol and was developed at the College of Physicians and Surgeons in New York. Long insensibility to pain is achieved by the oil, which holds and releases the anesthetic gradually into the tissues.

Ink for Writing on Glass Resists Acid and Fire

Ink that can be applied permanently to glass, porcelain or china is put on with a pen or fine brush, and its permanency is increased by gently warming the object. Non-inflammable and unaffected by strong solvents like alcohol and turpentine, the ink under tests resisted the corrosive action of hot sulphuric and other acids as well as strong alkalis.

Brake Booster to Help Driver Fits on Steering Post

Attached directly to the brake pedal, a power booster now on the market raises slight pressure of the foot to 200 pounds. Installation is made with ordinary tools, requiring no change in the braking system whether it is hydraulic or mechanical. The unit fits any make of car and does not interfere with engine performance.



Air-brake performance is obtained from this power booster acting like a giant's foot on the pedal

Giant Mural Depicts Air View of New York

At right, Carl Roters working on Manhattan-Bronx section of giant mural water-color painting for World's Fair. Below, notice the large brushes he employs; to right, fitting a section into mural



Occupying nearly 1,000 square feet at the New York World's Fair, a giant water-color mural painted by Carl Roters will show the New York metropolitan area as seen from the air. Described as the first large water-color mural ever attempted, it was executed by means of a new technique that resulted in a painting with the fidelity of a map and the fire of a stained-glass window. The artist used brushes twenty times as large as those ordinarily required by water-colorists. He painted, in eight sections, a quarter-scale color model of the mural, then produced the giant mural. The work was done with the aid of a full-scale working sketch of the map of the area, in chalk on detail paper, with land areas colored red, the river, sound and ocean areas in blue. The final work was in 114 sections which were assembled in checkerboard fashion. Each section of linen-backed water-color paper embraced an area of nine square feet, the largest size offering full

brush control. The mural will be lighted with a high-intensity direct light by a row of sixty-four elliptical aluminum reflectors, each containing a 150-watt incandescent lamp. The reflectors are so focused that the most intense light falls on those brilliantly colored areas accentuated by the artist in the painting. The exhibit will be in the World's Fair building of the Consolidated Edison company of New York.

4 drawing Place

Carp. 155 n. Clark

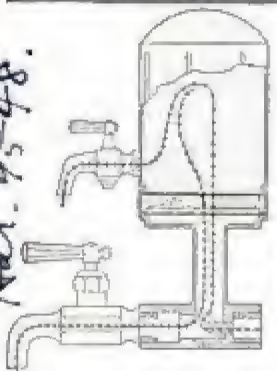
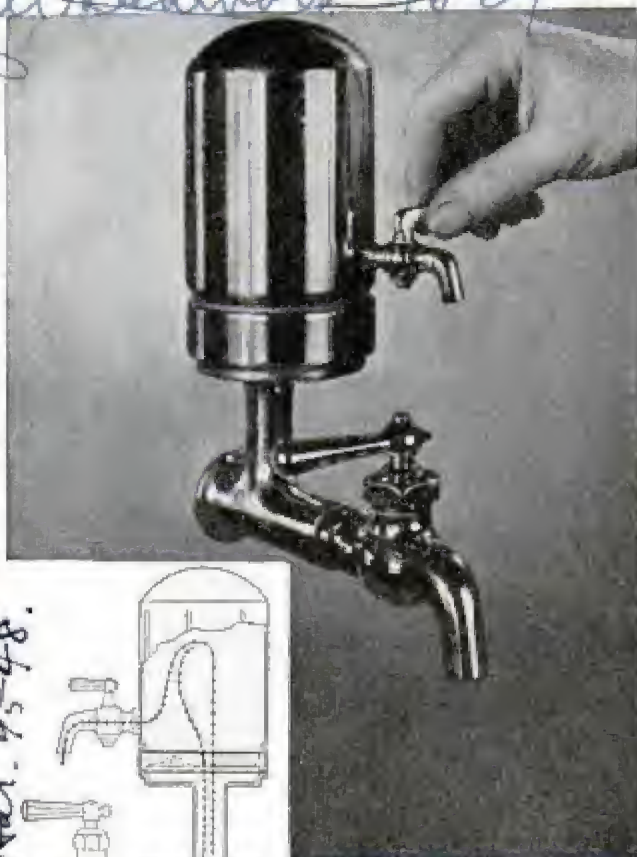
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POPULAR MECHANICS

12/23/38

Self-Cleaning Filter Fits Any Type Faucet



Filter, with user turning cleaning faucet. Inset, drawing shows principle of filter

Easy to install on any faucet, single or double, a self-cleaning stainless-steel water filter is ready for the market. It does not interfere with the flow of hot or cold water for washing purposes and it takes no space on the sink. Operating on the reverse-flow siphon principle, the filter cleans itself by flushing impurities out and into the sink each time the cold-water faucet is opened.

Air Records Are Nearing Limit Set for Today's Planes

Airmen who seek to break existing speed, distance and altitude records are beset by theoretical limits of the airplane as we know it today, according to Prof. William E. Durand of Stanford university. Airplanes, as we now know them, will not climb much beyond 60,000 feet, he predicts, about 4,000 feet above the present altitude record. The limit of speed is estimated at 500 miles per hour, and, for distance, from

8,000 to 9,000 miles. A speed record of 440.8 miles an hour has been made by an Italian seaplane which sacrificed everything to its engine, leaving only room enough for the pilot and a few gallons of fuel. This leaves a margin of sixty miles for later speed record attempts. Two British bombers recently flew more than 7,000 miles to set up a new distance mark, which, comparatively, does not come as near the limit as the established speed and altitude marks. However, this larger margin between actual and ideal performance is not surprising when we realize the remote chance of an absence of adverse weather conditions and the continuous functioning of all working parts during sixty to eighty hours required for the flight.

Three-Mile Breeze Turns Mill with 'Sails' Instead of Blades

Breezes as light as three miles an hour will operate a windmill that uses "sails" instead of the conventional rotating blades. It always starts with a downstroke of the pump, and over a given period can pump more water than the rotary type. A direction vane keeps the working parts toward the wind. Pressure of the wind against the sails exerts a lift like that on the wing



Wind lifts sails at top until gravity flips them around to give wind a new angle of attack

of an airplane, causing the sails to rise until gravity flips them around to give the wind another angle of attack and force them back up in the opposite direction. In a high wind a "hurricane control" pulls the sails to lessen the angle of attack and reduce their working area.

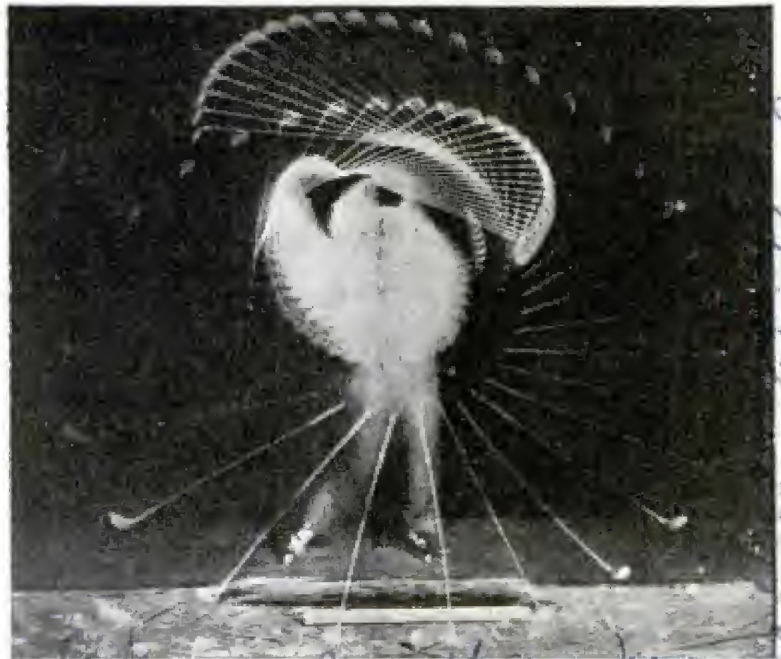
Tiny City Springs to Life at Touch of Button

Night turns to day and back to night in a five-minute cycle at the touch of a button which controls a home-built miniature electric village. To the strains of a musical background a curtain opens, the sun sets in natural colors, and a motorboat put-puts across the lake, passing sailboats along the way. As evening falls cows begin to moo, airplanes fly, and flowers give off actual perfume. Lights of the town vary in the night and a church bell tolls, while choir voices can be heard. Railroad semaphores operate to signal the approach of a tiny train. Soon the rising sun is welcomed by a crowing rooster, the train pulls into the depot, and a mail plane takes off with a roar. The model town was constructed by Franklin Avers, of Portage, Wis.



It is just a toy, but it comes to life and goes through a complete cycle of night and day in five minutes. All you do is press a button

Speed Photo "Stops" Golf Club Sixty-One Times in Drive



© Spalding Brothers

Count them if you want to. The sixty-one exposures start at the brightest streak of white. Note ball bounding away

Revealing what happens to a golf club swung in a mighty drive, a high-speed photograph shows a spiral the eye never sees. This picture was made for the research department of a sporting goods manufacturer to aid in improving the design and structure of his equipment. The golf club was "stopped" sixty-one times without blur in a series of exposures on one plate by flashing a gas-filled tube at the rate of 600 times a second, each flash, or exposure, having a duration of one one-hundred-

thousandth of a second. Only by sudden release of electrical energy into the lamp is this tremendous speed accomplished. Velocity of the golf club before impact with the ball was timed at 166 feet per second, and 144 feet per second after the impact, while the ball shot forward at a speed of 225 feet a second.

Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

'Shell Burst' Built on Truck Trains Military Observers



Seen from the air this cloth-draped auto resembles the explosion of a shell and is used in testing the work and equipment of army observers

Autogiros are undergoing tests by the field artillery to determine their value for military observation work. If successful they will either replace or supplement airplanes and balloons now being used. To simulate warfare, a mobile truck unit was covered with black and white cloth, appearing to airmen like the explosion of a fifty-five millimeter shrapnel shell. The autogiro hovering over this noiseless blast reports its observation back to the lines.

Fabric Fuel Tank for Airplanes Is Vibration-Proof

Fabric fuel tanks to withstand severe vibration on airplanes are announced by the Glenn L. Martin company, makers of flying boats and bombing planes. In tests made with the Mareng-fuel cell, as the bag

is known, it was still gas-tight after 700 hours of violent vibration, whereas twenty-five hours usually would be acceptable for metal tanks. The fabric, impregnated with synthetic rubber not dissolved by gasoline, tends to slow up loss of fuel through leaks caused by bullets, for example, and the leaks are repaired as easily as those in a tire's inner tube.

Windmill with Twin Propellers Pumps Water on Farm

Twin propellers pump all the water needed on a farm in northern Minnesota. The windmill was built by the farmer himself, using two disks of twelve metal blades each, mounted on the ends of a discarded differential shaft. The blades are three feet long. A metal arrow keeps the propellers turned to the wind however light.



Twin disks are mounted on old differential shaft

Built by John Harwood

Driver Re-Enacts Crash on Chart at "Trial"

Truck drivers for a Chicago department store are placed on trial before a jury of fellow employes whenever they are involved in a traffic accident, and the plan has reduced the accident rate remarkably. A large graph showing various typical street intersections is used to "re-enact" the crash. Dummy trucks of celluloid are placed on the chart to represent traffic at the time of the accident. Two "attorneys" question the driver, and the jury renders a verdict charging him with a degree of responsibility varying from none to 100 per cent. The driver's no-accident bonus is at stake.

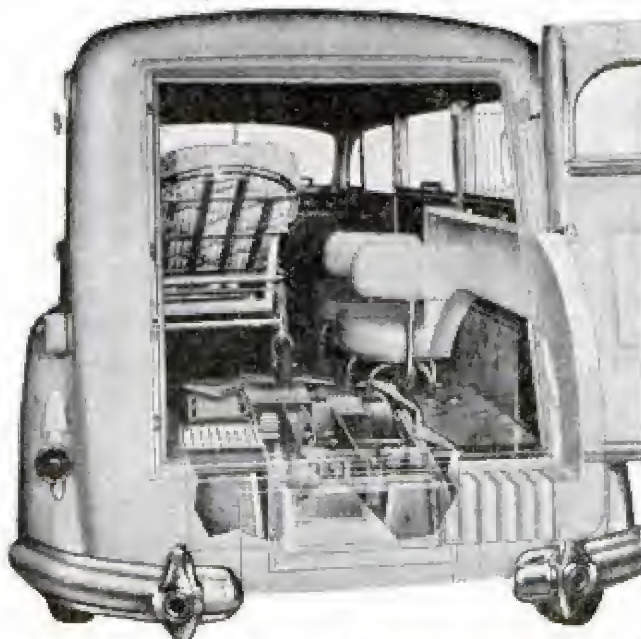


Ready-made chart with examples of various street intersections is used to "re-enact" traffic accident at truck driver's trial by company jury

Air Conditioner for Ambulance Is Installed under Floor

Comforts of air conditioning have reached the ambulance. A compact mechanical unit, which is set beneath the floor in a space normally required by the gasoline tank, draws fresh air from the outside through a grille. filters, cools and dehumid-

ifies it, and then passes it through a radiator into the ambulance interior. Temperature is automatically controlled by a thermostat. Power is supplied by a one-horsepower electric motor and an evaporative type of condenser is used.

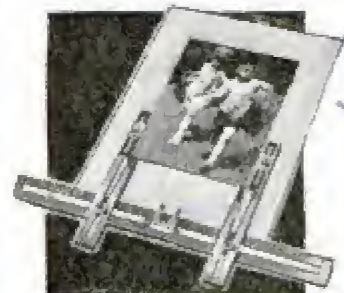


Cut-away section shows how air-conditioning unit is placed without taking up floor space in ambulance

Pictures Centered for Mounting

by Three-Way Ruler

Three simple measurements with a metal "H" ruler will center a photograph for mounting in much less time than you take to figure the center with pencil and ordinary ruler. The mount is placed in the center clip so that the same figure reads on the upper scale on both edges. Then the vertical members are set to the width of the picture, and adjusted so that their scale gives the measurement of the bottom border.





Drivers of midget speedsters in huddle before a race as track rules are reviewed for them

see March 1937 39.4

MIDGET automobile racing, which looked like a flash-in-the-pan sport a few years ago, is beginning to replace the big car races in popularity.

Spectators at the short quarter-of-a-mile tracks sit only a few feet away from the roaring cars, now being driven at speeds approaching big-car performance. The 100 or more midget tracks in the United States have been rebuilt for faster driving and soon board speedways, banked up to forty degrees on the turns, are going to permit faster speeds than ever.

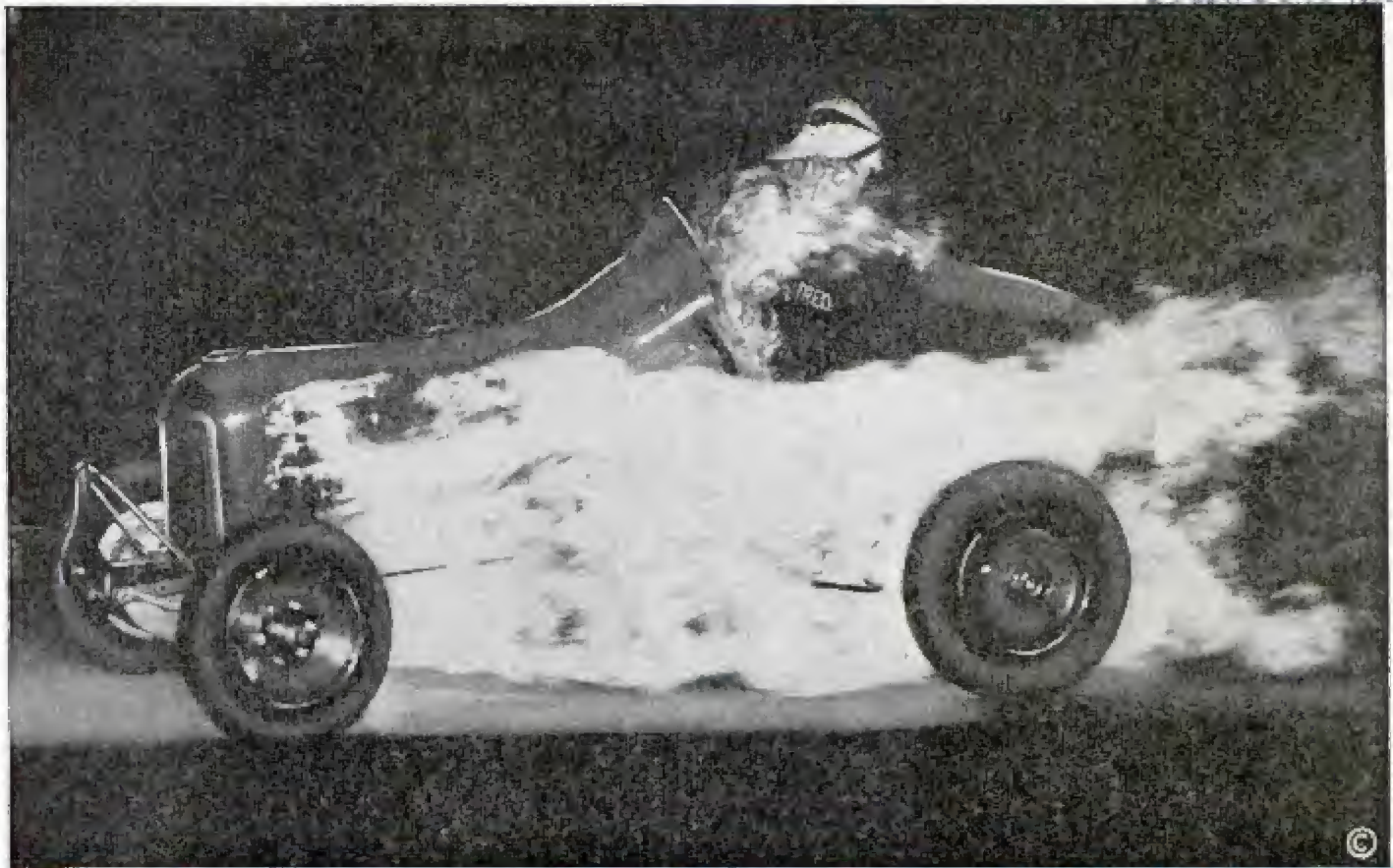
The baby race cars are small, but they are true racing machines. The most powerful of the miniature engines are only twenty-two inches long, yet they develop up to 100 horsepower, permitting wide-open straightaway speeds of up to 120 miles per hour. Cars have averaged 100 miles

per hour in 150-mile championship races around one-mile tracks.

The latest trend in the midgets is toward more complete streamlining, with smaller radiator cores in front and with high fish-tail sterns that seem to provide better control for the skidding and broadsliding in the turns and that are a real protection if a driver happens to roll over in a crash. Quick-change wheels and quick-change rear-end gears are being adopted so that drivers can groom their cars to fit the conditions of each individual race.

At the present high speeds a spill that was hardly dangerous a few years ago is apt to be quite serious. Accidents are bound to happen when half a dozen cars or more are packed in a tight bunch sliding around a turn, with every driver trying to steal the lead.

H1343

Reference: Midget Association
3814 92 Crawford St.
Los Angeles

the MIGHTY MIDGETS

One spectacular accident at a night speedway happened recently when a car's fuel line broke and gasoline under heavy pressure started to squirt over the hot motor block. The driver, aware only that his engine had stopped, pushed the clutch down and coasted for a few yards while pumping up the pressure on his fuel tank. Then he let the clutch out again to see if the engine would start. Instantly a spark ignited the quarts of fuel that had spilled over the engine compartment and the car was transformed into a flaming fifty-mile-per-hour comet. The driver slowed down quickly and jumped out but he spent weeks in the hospital.



Top photo © Carroll Photo Service

Top, spectacular photo of midget car that burst into flames at fifty miles per hour when fuel line broke. Bottom, driver overhauling steering assembly in preparation for another race



supply kit, his experience telling him which set to use after he judges the weather at the track.

The practice laps that a driver makes before a race program starts are really for testing out his motor instead of for getting used to the track. After a few laps he removes a spark plug and holds it against his palm, the degree of dampness of the plug telling him a great deal about his car-



Top, midget car turned on its side to facilitate work on engine. Center, "broadsliding" around turn on short dirt track. Bottom, cars in pit, ready to be pushed out on track and warmed up for race

More than any other kind of racing, midget races are won in the pits. Leading drivers such as Ronnie Householder, Bob Swanson, Fred Friday and Paul Russell drive brilliant races, but just as important as their skill in competition is the ability of themselves and their pit crews to tune their engines. No more than three or four cars out of a dozen in a typical race may be tuned to peak performance. This is because the tiny motors are so sensitive that even minor changes in atmospheric conditions may affect their power.

There are more than a dozen different grades of spark plugs and a good driver may carry as many as eight grades in his



buretion and valve timing. The sound of his exhaust is another key to valve timing and he tightens or slacks off on valve-spring tension if necessary. Fuel adjustments may have to be made after each minor change. Most drivers use their own

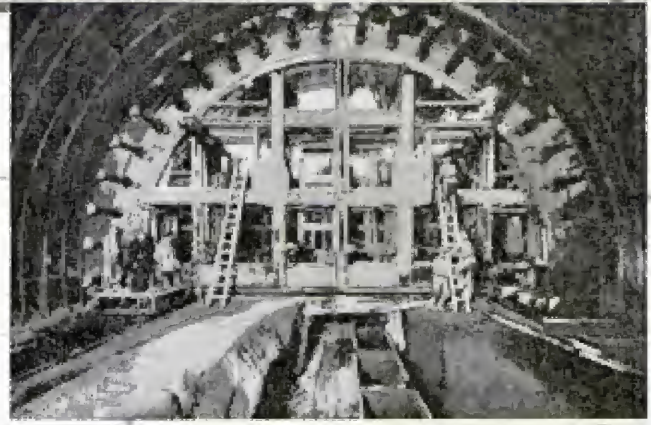
(Continued to page 116A)

Two-Mile Traffic Tunnel Links River Cities

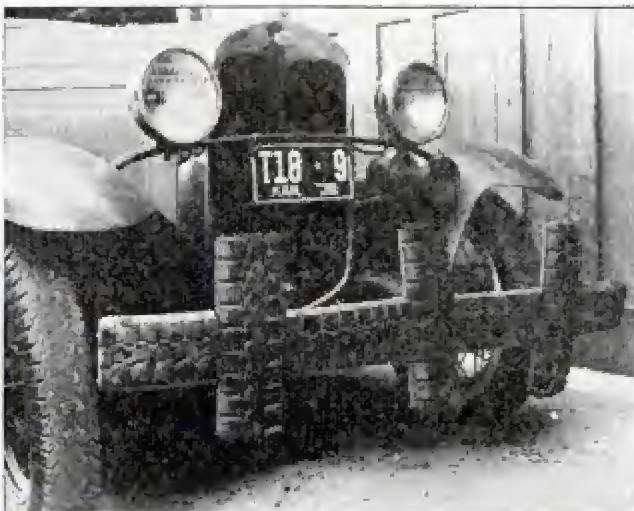


Above, diagram of Mersey river tunnel and ventilating stations. Right, excavating Liverpool approach

Connecting Liverpool and Birkenhead with a traffic tunnel under the River Mersey was one of the outstanding engineering feats of recent years. The main bore is 2.13 miles long, and to ventilate it properly required several stations on each shore, where powerful fans exhaust the stale air and drive a fresh supply through ducts. The tunnel has a diameter of forty-four feet.



Rubber-Covered Bumper Pushes Car without a Scratch



This bumper gives cars a push without a scratch

To protect the customer's automobile from bumps and scratches, a Kansas garage owner has covered the bumper of his service car with old tires from which the bead and part of the sidewall have been cut. This eliminates the risk of damage from different bumper heights and from scraping bumper against bumper when giving a stalled car a "boost." The three vertical pieces are made of heavy strap iron. The tire pieces are bolted to the iron.

When an auto travels seventy miles an hour, air rushes through its carburetor at a rate as high as 250 miles an hour.

Foot-and-Hand Cycle Has Streamline Hood

Propelled by pedals, like a bicycle, and by hand levers, worked by alternate movements of the arms, a new cycle fitted with a streamline canvas hood has been demonstrated in France. The hood, which has a light metal framework, fits down over the rider's shoulders, cutting down air resistance at high speeds. The seat of the vehicle is only about eighteen inches above the ground and virtually in the same plane as the wheel hubs. The pedals or stirrups are connected to the hub of the front wheel and the rider pushes straight ahead.

Left, preparing for speed run with bicycle hood. Note double drive on the bike. Below, cycling at high speed as hood reduces wind resistance



Oil Pressure Runs Engine

Engineers have turned to oil under pressure to drive motors at high speed, thus adding another power source for tools. They describe its essential principle as resembling that of the steam turbine, except that oil makes things move, not steam. The oil serves a double purpose, being the source of power, and also the lubricant.

Highways Made Safer by Wall Developed from Roller-Coaster Idea

Out of the thrilling curves of giant roller coasters has come an idea for increasing highway safety. Cars of amusement rides negotiate turns so sharp that neither the wheel flanges nor super-elevation of the curve would normally keep them on the track. The trick is achieved by mounting rollers on the side of the car so an addi-

tional restoring force is obtained. Adapting this idea for a central highway barrier wall, Yale university traffic experts devised a sloping metal surface whose profile is a parabolic curve. As the front tire of a car starts to ride up this surface it gradually reaches a point where the side walls of the tire press against the barrier

Vickers, Inc.
1402 Oakman
Detroit.
1469

R. R. Idemari,
Detroit, Mich.
1458

Bureau of Street Traffic Research
H. H. Miller, H. C. Chittlock

14171
wall. This creates a restoring force which re-directs the car away from the barrier and back onto the roadway. No part of the car except the sides of the tires touches the wall, and the action is gentle if the driver allows the car to guide itself for the instant it is on the barrier. A full size parabolic deflector is four and one-half feet high and four feet wide at its base. Extensive tests indicate that the barrier is effective with cars and trucks at speeds up to sixty miles per hour.

1421
**Power-Driven Saw
Fells Trees and
Cuts Up Logs**

Taking power from a portable air compressor, a crosscut saw fells trees and cuts them into logs or firewood lengths. The saw blade, driven by a piston, will cut through a hardwood log twenty-six inches in diameter in three minutes. If it becomes jammed the blade is readily detached from the frame so it can be released from the log.



Two men grip the saw frame as the blade, reciprocated by an air compressor, cuts through a big log

14171
Curoline Sales Co.
**Doctors "Pipe" Cold Light
through Curved Plastic Rods**
567 Third Ave. New York



Light travels around curve of plastic rod to patient's mouth while dentist uses both hands for work. Inset, examining sinuses with cold light

Chemistry has put new tools in the hands of the doctor, surgeon and dentist—curved instruments that bend the light and focus it just where it is needed. For the dentist and throat specialist there is a combined tongue depressor and flashlight that leaves the operator's hands more free for work. The surgeon can use a lighted retractor that illuminates the site of operation while holding back the tissues. Transilluminators "pipe" light needed for examination of the sinuses. Curved rods ten feet long can be connected to a hospital ceiling or a portable stand. All these instruments are made of "Lucite," a plastic which has the property of bending light like quartz, so that light rays can travel from the bulb at the base to the tip without creating any glare along the walls.

The Hardy Compressor Co.

E. D. du Pont de Nemours & Co. Plastic Sales Dept. 567 Third Ave. New York

MAKING *the* GRADE



Turning a corner on skis calls for special technique. Hans Hauser, thrice Austrian ski champion, shows two pupils at Sun Valley, Ida., the "kick turn," one of the first steps to learn

IF YOU can walk, you can ski! To start, you need only a little self-confidence—and a pair of skis. In fact, you'll probably need more confidence that first day when a gentle hillside that looks like a mountain to you starts sliding under your wobbly legs than on the day, weeks hence, when you streak down a precipitous jump and soar out into space for your first solo.

But skiing is easy to learn; you can take that from Hans Hauser, three-time open ski champion of Austria and now head of the ski school at Sun Valley, winter resort in the Sawtooth mountains of Idaho. Here's what he tells his "freshman" class before he lets them touch snow:

"Don't be afraid to look awkward or ungainly; listen to your instructor, remember what he says and you're on the road to becoming a skier."

Hauser tells you to begin your skiing at home.

"After the first few steps, it's all a matter of practice," he says, "but those first steps should be in the home, where the novice can put the shiny new skis on his feet and get the feel of them. During those first steps, the beginner should be sure the skis fit perfectly, especially the boots; for a great deal of his future success is going to depend on the skis feeling just right. Then comes the first try at the snow, when the beginner's confidence is important, even though an instructor is present to point out any mistakes."

The first precaution the skier must take is to see that all snow is removed from the ski boots. Then the toe should be thrust firmly into the toe-binding, so that the strap fits snugly. It is important to remember that the foot must be parallel to the ski and not loose.

Let yourself go. Tenseness is one of the beginner's troubles. As in many other

on SKIS



Overhead, a jumper takes off with the greatest of ease from a rocky mountain slope; below, a party of skiers rides the Sun Valley "snow tank" to the top of a run

sports, the novice should relax and spend at least several hours of his first day walking. He should be equipped, of course, with the two ski poles, both placed in the snow vertically, the points about even with the skier's toes.

As you thrust your left foot forward, push with the left ski pole. At the same time the right ski pole should be thrust ahead to a position two feet in front of the

left foot. The second step is the reverse of the first, and when grade and snow permit, the skier should take advantage of his glide between steps. After thrusting forward the left ski, relax and glide before pushing your right ski forward.

The second item to learn is the kick turn, the easiest way to reverse direction. From



*Left, fast action on a turn!
Above, skiing under arches
to learn the downhill crouch
position, knees bent and
weight carried forward*

normal position, skis and ski poles resting in the snow even with the toes, the skier puts his right pole one foot in back of his feet and his left pole one foot forward, putting plenty of weight on the poles.

Now lift the right ski, point upward until its back end rests in the snow by the tip of the left ski. Then swing the right ski down and back so that it rests at right angles with the left ski—its point resting in the snow near the rear end of the left ski.

With your weight placed heavily on the ski poles, the left ski is now brought around to face the same direction as the right ski. At this point the ski poles are both on the left side of the skier—the op-

posite side to the direction which the kick turn was made. The entire procedure is reversed when a kick turn to the left is made.

So far, so good. You've learned to manipulate your skis, but you aren't getting anywhere. Coach Hauser suggests that you're ready for promotion, and the next lesson is to try a straightaway on those slippery slats.

"It is best to pick a very gentle slope," the ski champion advises.

"The skis should be parallel, about two or three inches apart. One ski should be forward about half the length of your ski boot. Ski poles are about six inches in back of your boots. Always rest the poles

Here is where the fun comes in. Skijoring provides plenty of thrills; the rider below has towed the skier past a snow-bank for a jump. Don't try that your first day on skis!





in back of you, never forward, and grasp them tightly.

"Move either the left or right foot forward in a slow glide. Give yourself a slight push with the poles. Then bring the other foot forward, a little behind the starting foot. If the slope is gentle enough you won't gather too much speed.

(Continued to page 134A)



Top, Hans Hauser teaching pupils the "crouch," and a skier plowing snow on a downhill turn. Right, the ambition of all skiers—soaring out into space from a high jump. Notice the body perfectly balanced. Bottom, beginners learning the position for hill-climbing

Photos courtesy
Union Pacific railroad



Highway Snowplow Shovels and Loads in Single Operation



Truck follows alongside or behind to receive snow and ice picked up by scraper and elevated to long conveyor on top

Picking up snow and ice as it moves along the road, a motor-driven plow loads trucks at a top speed of ten cubic yards per minute. Arms on the scraper feed snow to the conveyor where it is lifted for discharge into a truck. By means of controlling levers the operator, seated high in the cab, can swing the conveyor to the rear or to either side, and also make vertical adjustments of the gathering head. In addition to snow and ice, the loader will handle ashes, coal and cinders.

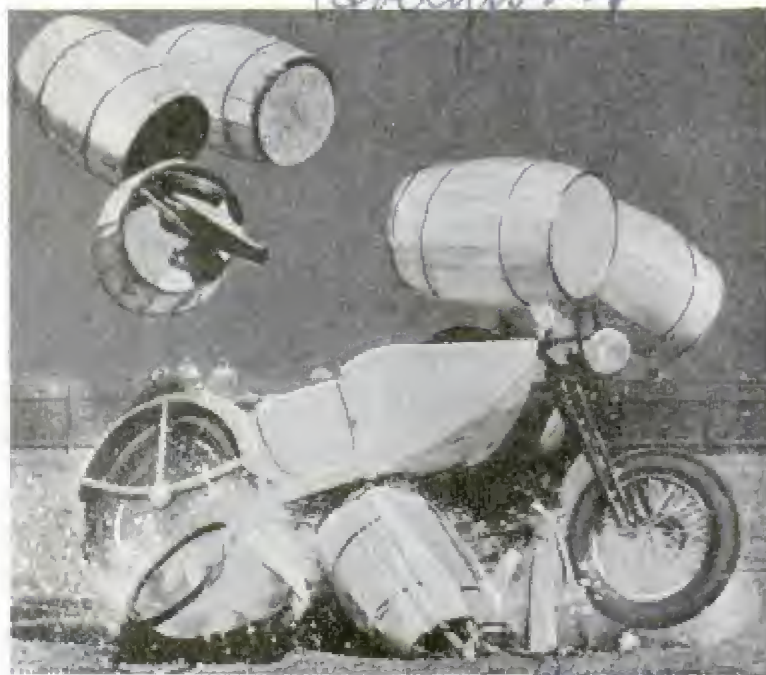
Freak Accidents Spare Some, Kill Others

Fate took it out on many an individual last year in highly unusual ways and spared others in fashions equally surprising, according to the National Safety Council. Three oil workers were at work atop a storage tank, when an explosion shot flames around it and also blew away their only avenue of escape, a ladder. A second blast set the ladder back in place, and the men clambered down. A hurrying fireman slid

down the firehouse pole with such speed that matches in his pocket caught fire. An automobile moving over a bridge as a train passed below swerved to avoid another car, then skidded through a six-foot iron rail, plunging down and landing on its wheels upon a coach of the passing train. But no one was hurt. The automobile bounced safely off the coach. At the Chicago municipal airport an Air Corps Reserve private climbed on the fuselage of a plane to service it. The pilot, unaware of his presence, took off, but someone saw the "cowboy" and the plane was called back. A two-year-old girl suffered only a slight cut on the chin when struck by a 250-ton locomotive and catapulted in the air whereas an eighteen-months-old boy was electrocuted as he chewed the cord of a bridge lamp.

Daredevil Cyclist Smashes through Wall of Barrels

Reducing barrels to hoops and staves is the business of Cary Lofton, movie-stunt daredevil, but he does it the hard way. His specialty is riding his motorcycle through a wall of barrels.



Motorcycle stunt rider smashing through a stack of barrels at top speed. Splinters fly, but he comes through unscathed

207 Wacker Drive
Chicago

1470

Franklin, Pa
Science Service
2/3/38

Thousands of Models Carved by One Man



Miniatures of nearly everything ever built by man form part of a huge collection of models created by Lawson Digett, hobbyist extraordinary, who started whittling a quarter of a century ago. Hurrying home from work this model builder dons overalls and spends several hours each evening in the home workshop. Besides automobiles and airplanes, he has constructed several tiny cities. His first city grew bigger and bigger until, tiring of moving it about, the maker doomed it for destruction. An "air raid party" followed, in which bombs fell upon the miniature to end the vacant-lot sized project. Now his cities are kept small enough to fit a table top. White pine is the

Tiny auto wheel being carved from white pine. Top, 500 scale models form only a small part of the total

basic material for most of the creations, although aluminum pie plates, broken round glass from toothbrush containers for windshields, and pins with the heads clipped are employed in automobiles. A saw, tack hammer, wood rasp, pliers, tinsnip and jackknife are his only tools. He requires about three evenings to carve an average automobile. Cars in his collection representing those which have established world records are among the favorites.

At a speed of sixty miles an hour, an average size automobile tire revolves 43,000 times every hour and, during a day's driving, may flex 360,000 times.

12 1/2 N Beach St.

Studies made by
B. J. Goodrich Co.
Ahron, Ohio

(Faint bleed-through from the reverse side)



able "hornets" The torpedoes may

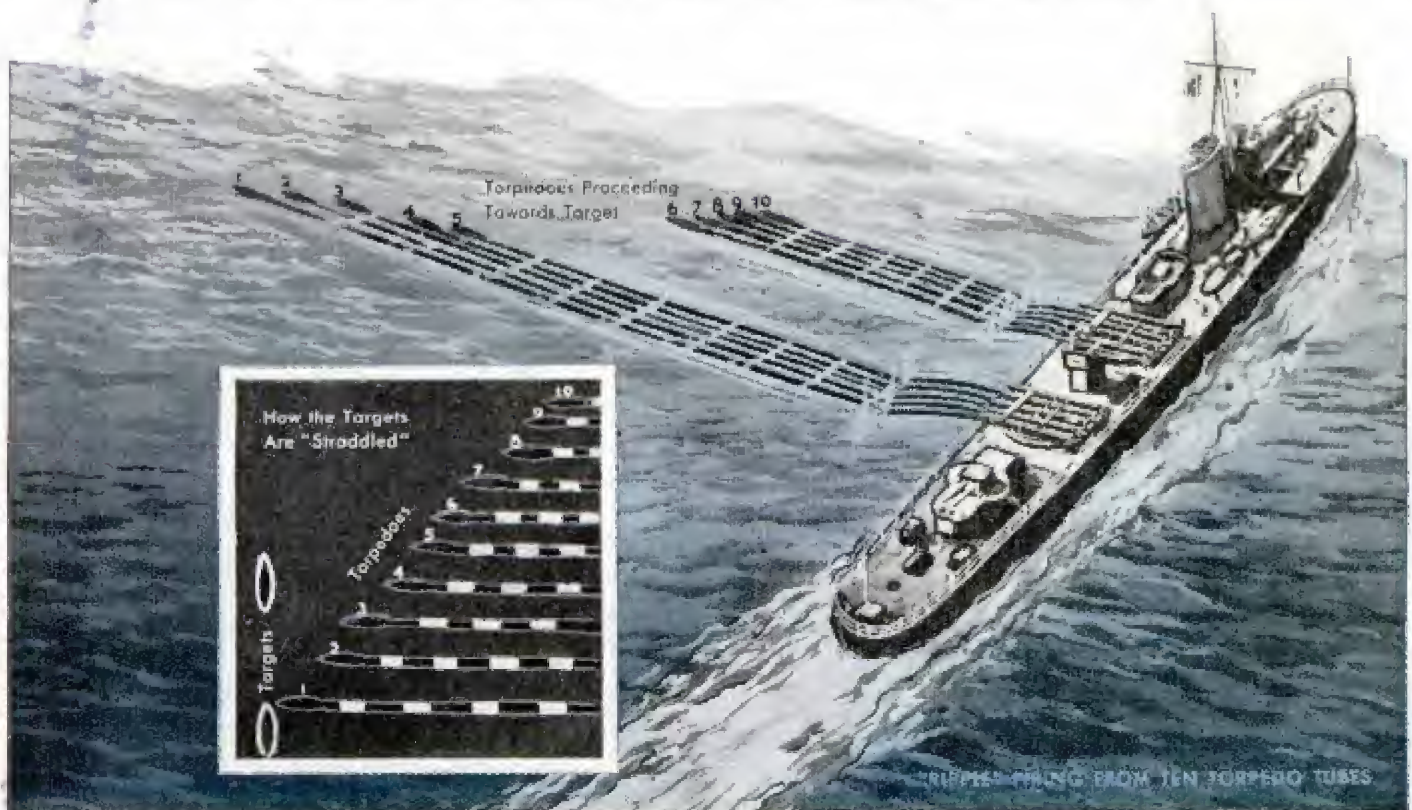
(Faint bleed-through from the reverse side)

The torpedoes may be fired in "ripple" fashion, that is in a stream, one after the other leaving the tubes and reaching the vicinity of an enemy ship in succession. Since the torpedoes spread out as they are fired, the chance of hitting the target is much greater than if a single torpedo were fired at a time. Even though the target ship may be moving at full speed, the



spreading stream of projectiles considerably reduces the likelihood of the enemy's escape. In addition, each destroyer is provided with depth charges for war against enemy submarines. Two depth-throwers are located to port and starboard and a discharger or depth-charge dropper is fitted at the stern. After the hostile submarine has been located by the air-bubble streak, the destroyer proceeds at full speed over him and starts to discharge its depth charges. The throwing mechanism hurls the 300-pound explosives 120 feet to port and starboard and dead astern, literally blanketing the submarine below. Since the charges are set to explode at varying depths, the chance of a hit is even greater. The water pressure created by the explosions is sufficient to cause heavy leakage in the hull of the most stoutly constructed

underwater craft. Additional armament of the new destroyers includes six 4.7-inch guns in pairs and multiple pom-poms firing two-pound shells with machine-gun rapidity for defense against aircraft. High-speed operation is another feature of these "sea hornets." Although they have only one streamline funnel, their boilers are very efficient, when compared with those used in warcraft up to this time. The boilers are of the water-tube, high-pressure type and are housed in inclosed stokeholds. Turbines developing 40,000 horsepower give a speed in excess of thirty-five knots. This type of destroyer is the first ever designed for the British fleet with only one funnel. Length of the craft is 348 feet at the waterline and the displacement is 1,690 tons. Each of these powerful warcraft is manned by a crew of 218.



Top, view of the speedy one-funnel boat. Bottom, how ten torpedoes are fired from the quintuple tubes in a ripple at enemy ship. Inset, method of firing which increases the chance of hitting an enemy ship as it speeds along the surface

Magnetic Rocks Are 'Hooked' Like Fish with Pole and Line



This rock weighs 150 pounds and is attracting a needle at the end of its thread. It also holds hairpins and a horseshoe

Prospectors who seek magnetic meteorites and chunks of magnetic ore in the Colorado desert of southern California use as regular equipment a fishpole and a long line with a heavy iron nail instead of a hook. Flipping his nail from rock to rock as he slowly strolls across the desert, the prospector depends upon the magnetic pull of a magnetized rock to hold the iron nail. Such rocks are sold as specimens.

Plants "Analyze" Their Own Soil by Symptoms of Hunger

Chemists can analyze soils to determine whether they provide all the chemical foods necessary for plant growth, but the plants themselves can do the job better. The skilled botanist can read telltale symptoms of diet deficiencies in the leaves of the plant. Using tobacco as a "test-tube" plant, Dr. J. E. McMurtrey of the U. S. De-

partment of Agriculture has found that lack of nitrogen in the soil shows up in paler green leaves, the lower leaves turning yellow and drying out to a light brown. If the soil lacks phosphorus, he says, the leaves are darker green and narrow, and the plant remains immature. Iron starvation is indicated when the leaves fail to develop any green color except along the veins.

'Bike' Wheel on Motor Bus Measures Acceleration

Before a passenger bus is placed in service it must meet an acceleration test administered by a bicycle wheel attached to the front step. A flexible shaft and gearing arrangement connect the wheel to registering apparatus inside the bus. The distance traveled in feet per second and in miles per hour is recorded on a moving tape and also tabulated on meters. The "bike" wheel is mounted to rise and fall with road irregularities, and to make the test accurate the bus must travel its trial runs in two directions on the same course.



Flexible shaft from bicycle wheel to recording apparatus tells story of accelerating ability of bus

Translucent Plastic Statues Lighted on Inside

Translucent figures of heroic size, cast in synthetic plastic material and illuminated from within, will feature the exhibit of the United States government at the New York World's Fair. Edward Heckler Burdick designed the exhibit, which is divided into twelve parts, representing the twelve functions of government as they affect the average citizen. In each section the central figure is a sculptured mass of cast plastic, nine and one-half feet high, resting on a base four feet and two inches high and weighing 1,500 pounds. The figure, lighted from within, symbolizes the function of government depicted by the section. From a height of thirty-five feet, a highly colored moving mural appears to flow down into the plastic figure, telling the history of the governmental function which each section represents. On either side of the lighted figure is a series of miniature displays, or dioramas. To give the visitor the effect of going from darkness into light, the exhibition hall will be unlighted except for the illumination given off by the exhibits.



Here is how the plastic statues will look. Illumination comes from lights located inside the figure and base

The giant figures were cast by a new technique involving the use of rubber molds and certain periods of curing.

Transparent Film of Rubber Will Resist Water and Fire



Transparent umbrella made from new material

Rubber in the form of transparent sheets is introducing virtually a new industry with products ranging from raincoats to oxygen tents. Called Pliofilm, the material is based on a hydrochloride of rubber and is inherently waterproof and non-inflammable. It neither shrinks nor expands, and forms an odorless wrapping film unaffected by weather, mold, insects, oils, or by weak acids or alkalies, and so may be used as packaging material in direct contact with foods. It is also in demand for transparent curtains, umbrellas, aprons, garment bags, tobacco pouches and the like. The material is produced in five thicknesses.

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.



HOTELS

Above, looking from tip of Boeing clipper's right wing to tip of left wing, 152 feet. Below, artist's sketch of 100-passenger ship expected to be the Clipper of Tomorrow. It would be about twice as large as today's modern transports

LOCOMOTIVE power and all the services and conveniences of the modern hotel have been incorporated into new giants of the airways which are ready to speed the American traveler over land or sea in safety once considered impossible to achieve in aviation.

Steam heating, air-conditioning, hot and cold running water, artistic decorations, individual service from carefully trained attendants, electrically operated kitchen and home appliances, telephones, luxurious berths and even bridal suites—these

are a few of the features of the latest aircraft intended for use on regular runs.

Of three super-airliners which have been completed and tested successfully, two either are in service or soon will be flying scheduled routes.

Largest of the three is the Boeing "314," Pan American Airways clipper, a seventy-four passenger cruiser that is the first commercial airplane capable of carrying a sizable load of passengers and cargo across either the Atlantic or Pacific ocean.

Weighing 82,500 pounds and driven by four 1,500-horsepower engines, any two of which are able to keep the giant craft in the air while work is being done on the others, the "314" has twice as much power as the average railroad locomotive and a range of 4,000 miles with forty passengers aboard. Its top speed is approximately 200 miles per hour. Catwalks through the wings lead to the engine nacelles, each roomy enough for several men to work. Full feathering propellers permit the stop-

Boeing Aircraft Co.

H 1229



on the WING

ping of engines completely during flight so that mechanics may service or repair the huge motors.

This "Queen Mary of the air" is the first airplane with two full decks, connected by a spiral staircase. It has eighteen separate rooms within the hull proper, not counting the four "engine rooms." The ship measures 109 feet long and has a wing span of 152 feet, nearly one-half the length of a city block. The hull has an inside volume equal to that of a five-room house including basement, and the craft's thermostatically controlled system produces nearly five times as much heat as the heating plant of a modern seven-room house. Fuel tanks hold enough gasoline to



Above, Douglas "DC-4" climbing on only two engines. Note that two propellers are idle. Below, conferring in "mock-up" of the Boeing "Stratoliner's" pilots' compartment

Douglas Aircraft Company

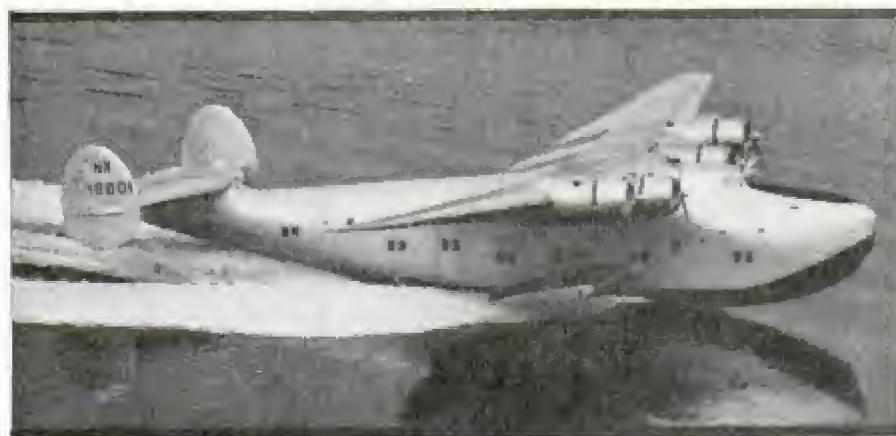


drive an automobile two and one-half times around the world, 4,300 gallons, and the cargo holds have a capacity of 10,000 pounds of mail and air express. There are approximately 50,000 different parts in the clipper, assembled with 15,200 bolts and 1,000,000 rivets. The electrical system contains eleven and one-half miles of wiring, installed in 400 runs of conduit, and outlets for 160 light bulbs.

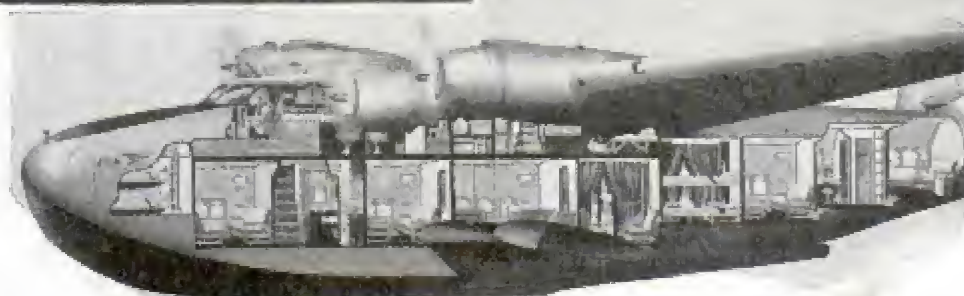
stance made of curled horsehair impregnated with liquid rubber. Color schemes of the upholstery, wall and ceiling lining, deep carpets and trimmings vary in different compartments. Double windows in each compartment are fitted with Venetian blinds.

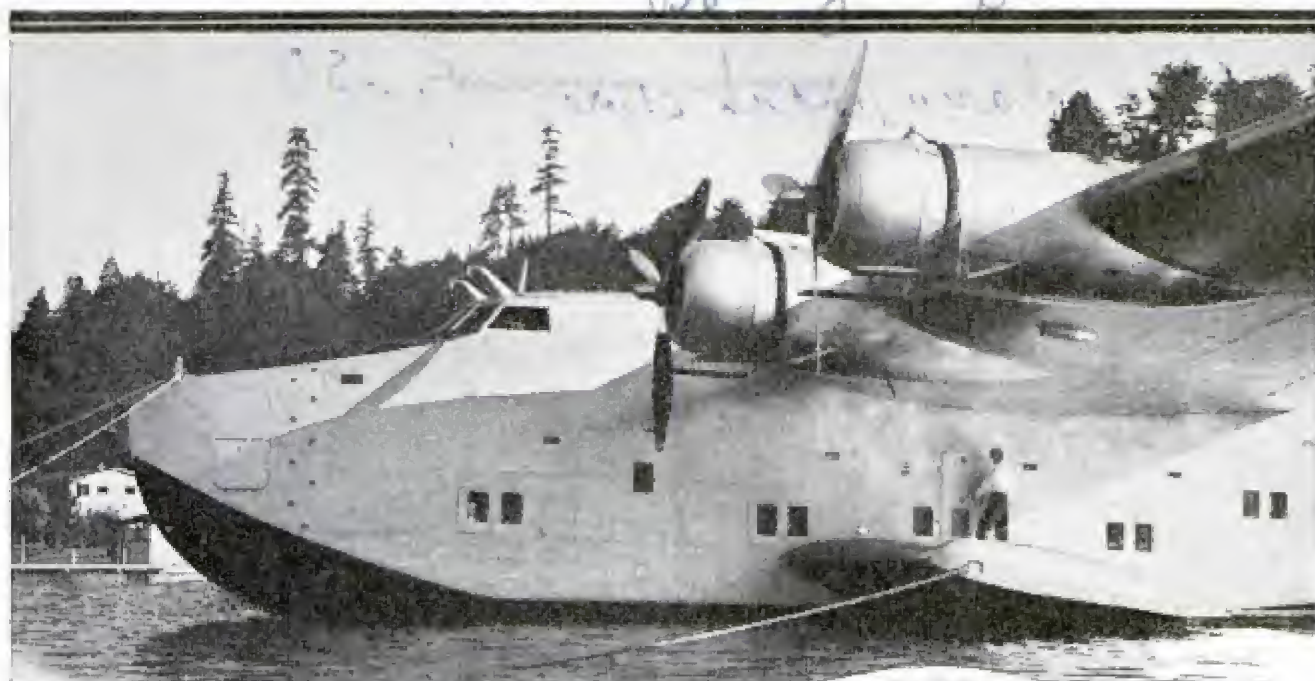
The bridal suite is attractively furnished with a triple seat, davenport type convertible into upper and lower berth, built-in settee, dressing table, two end tables, mirrors, washstand and cabinet and an overstuffed chair.

Modern tables between casually arranged overstuffed chairs offer accommodations for fourteen passengers at a time in the dining saloon. The



Top, Douglas "DC-4" has nose wheel for safe landing. It retracts when the ship is in the air. Center, Boeing clipper taking off. Bottom, cutaway view of Boeing clipper shows passengers' comfortable quarters on the main deck





galley is equipped with cupboards, serving tables, drawers and thermos containers for serving meals to the plane's seventy-four passengers and crew of eight. Between meals it may be converted into a bar.

The clipper's control deck provides liberal working space for the flight crew of six. At the forward end are the pilot's and co-pilot's stations and behind the pilot is the navigator's station, with a broad table for full-sized nautical charts. Across from the navigator is the radio operator's desk, with complete equipment including radio direction finder, three transmitters and four receivers. Behind the navigator is the master's desk and

(Continued to page 114A)



Top, clipper at its moorings. Circle, officials test passenger compartment. Bottom, clipper landing after test flight. Note wing flaps in lowered position to decrease speed



"Fishing Pole" Lifts Camera for Odd Angles

Many Kodak store

\$6.50



© Three Lions

Top, right, taking picture from overhead with "fishing-pole" camera, and, left, the result. Below, camera on tilting head with string running through screw eye to shutter release



Unusual picture angles can be obtained easily by mounting the camera on a long pole to extend over the heads of bystanders. A photographer adopted this idea after falling out of a tree in an unsuccessful attempt to obtain a picture. With four sections, each four feet long, he made a sixteen-foot pole. At the top is an ordinary tilting-top bracket on which the camera is mounted. This allows the camera to be set at any angle and the shutter is operated by a string running down the rod through screw eyes. With this arrangement the photographer can snap parades from behind the lines, or even picture himself from an odd angle.

Allergic People Prove to Be Smarter in Tests Given College Freshmen

If you suffer with sniffles and wheezes you are likely to have above average intelligence. That is the conclusion drawn from a survey made by the University of Michigan health service, in which freshmen entering the university from 1931 to 1935

were classified into five groups according to their symptoms and family history of allergy, the strange disease which makes individuals sensitive to certain substances. The five groups ranged from students known to have some type of allergy, to in-

Dr. Bonaventura

dividuals with no symptoms and no family history of sensitiveness to the ailment. In almost every case the allergy groups had fewer failures in the entrance examinations and more students in the upper bracket of the intelligence test ratings, than did the members of the group who had no symptoms of allergy.

14466.

Motor-Driven Tutor Teaches Body Swim Strokes

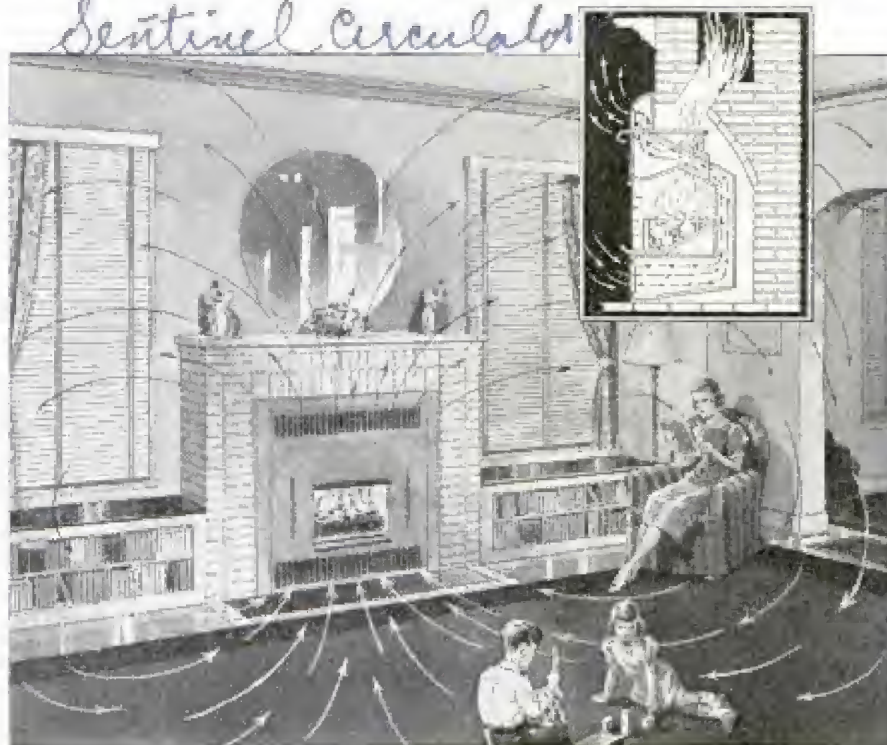
First lessons in swimming are given by an electric instructor that puts the pupil's body through the proper strokes. The beginner lies prone on the apparatus, and his arms, leg, head and body are taken through the motions by a series of five cams operated by an electric motor. Several lessons accustom the limbs to the strokes and it becomes automatic when tried in the pool.



Beginner "memorizes" swim strokes taught by robot

Air Circulation in Fireplace Sends More Heat into Room

Sentinel Circulator



Heated air is distributed in room as indicated by black and white arrows. Inset shows chamber around circulator where air is heated

Cold, drafty air from the floor is drawn into a fireplace circulator, heated in the air chamber, and distributed evenly to all parts of the room. The entire unit is constructed to fit into any fireplace, being installed without making changes or alterations in the original equipment. Having an opening twenty inches long, the circulator is of ample size for burning sixteen-inch firewood, and the grate is so designed that hard fuel also may be used. Setting the damper is simple; it is readily adjusted for a large or small fire or closed tight when not in use. Large air passages permit rapid circulation of warmth at all times. The grate is removable for cleaning.

Sliding Filter for Camera Lens Provides Five Changes

Mounted in a series of five in a sliding panel, filters for movie cameras are instantly interchangeable to meet varying conditions. The panel mount also provides a lens shade.



Photographic Specialist, Inc.
1123 Broadway, New York

Skaters Enjoy Summer Ice under Blazing Sun

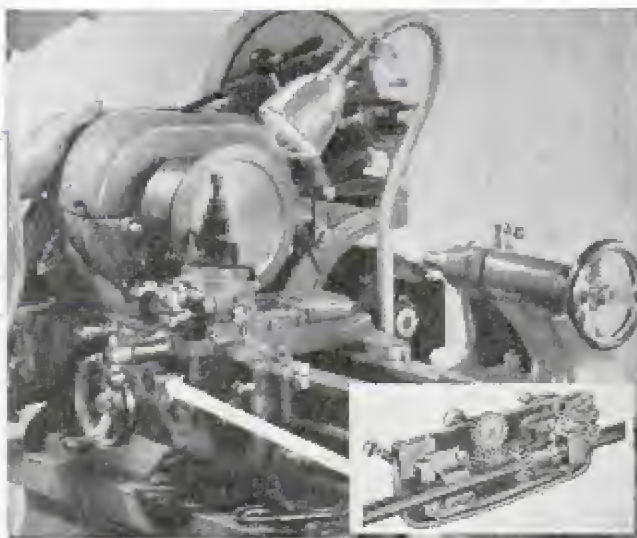


Ice skating rinks like this, where skaters can glide on hottest summer days, may be built in some of the country's largest cities. On the right of the stage can be seen part of the large orchestra stand.

Blazing sunshine does not melt the ice of an outdoor skating rink recently completed in Los Angeles, and skaters may enjoy their sport all summer long. The skating area, 210 by 100 feet, has a one and one-half inch water ice floor kept solid by the circulation of 24,000 gallons of brine that moves along patented corrugations in a

white enameled steel floor below the ice. A spectator's gallery seating 7,000 people, a stage, and other buildings around the rink block off warm winds which otherwise would remove the blanket of cold air above the ice and permit melting. New design of freezing equipment solidifies fifty tons of water in about four hours.

Lathe Has Power Cross-Feed and Is Quick-Reversing



Inset shows bevel gearing arrangement of power cross-feed on latest type bench lathe

Just made available to machine-tool users is a bench lathe equipped with power cross-feed. Longitudinal and cross-feeds are instantly reversible. This lathe has a V-belt drive, a wide speed range, and compact controls. Pushing a knob on the front of the apron engages the cross slide screw.

Quick-Frozen Food in Cans Sealed to Prevent Drying

Ripe fruits and vegetables may be purchased in the can because of a process for continuous quick-freezing under production-line methods which has been developed for canneries. Among foods already

Atlas Press Co.

Food Machinery Corp.

successfully frozen in cans are orange and lemon juice; pulps of apricot, nectarine, plum and youngberry; avacado slices and pulp; milk, cream, eggs, peas, asparagus, string beans and lima beans. The vegetables are handled both as a dry pack and with brine. Since cans are hermetically sealed with a vacuum closer, dehydration is eliminated and the original quality of fresh food is protected from deterioration.

H1406.

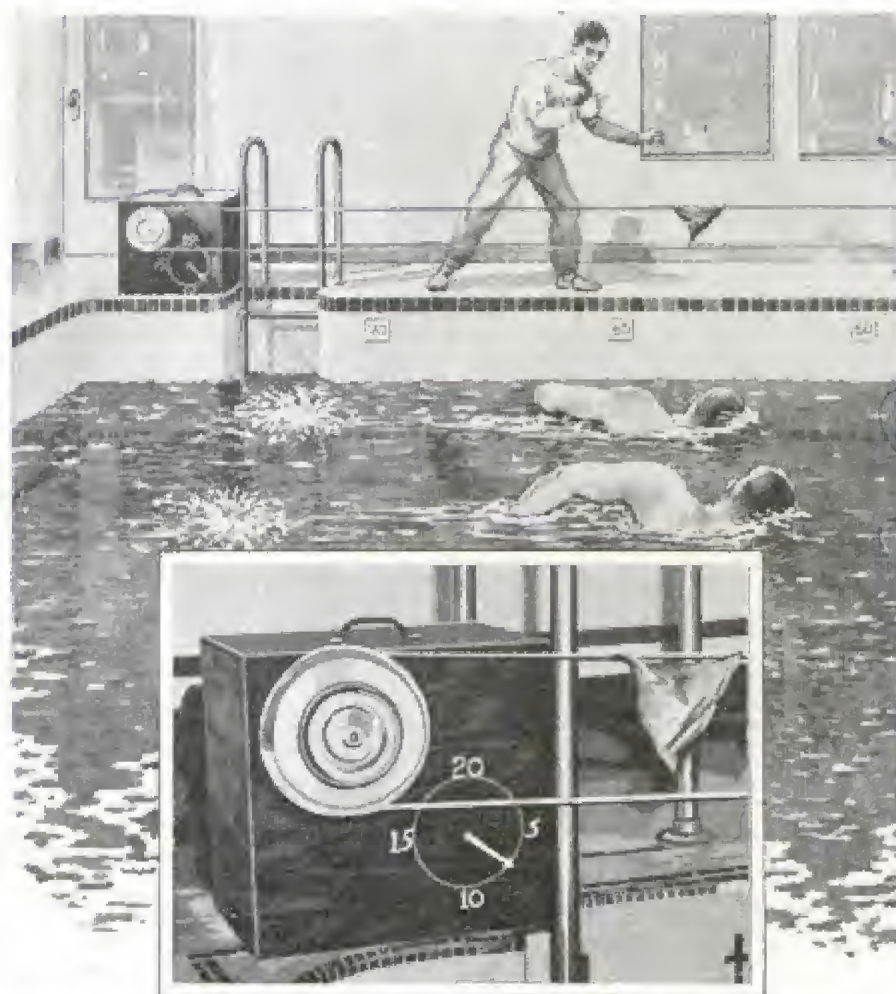
Bicyclist Tours with Trailer Carrying Built-In Bed

Towing his bedroom behind him in a streamline trailer, a California bicyclist is at home wherever he stops for the night. The eight-foot trailer offers ample room to stretch out in comfort on its built-in bed. It is thirty-eight inches high and thirty-six inches wide. Bob McCulley, who built it, plans a tour from California to Florida.



Bicycle tourist is at home wherever he stops, with a comfortable bed built inside eight-foot trailer which, fully equipped, weighs 135 pounds

Automatic Timer Sets Pace and Counts Swimmers' Laps



Flag traveling on line paces swimmers at any speed desired, relieving coach of need for stop watch. Numbered dial counts laps in distance swim

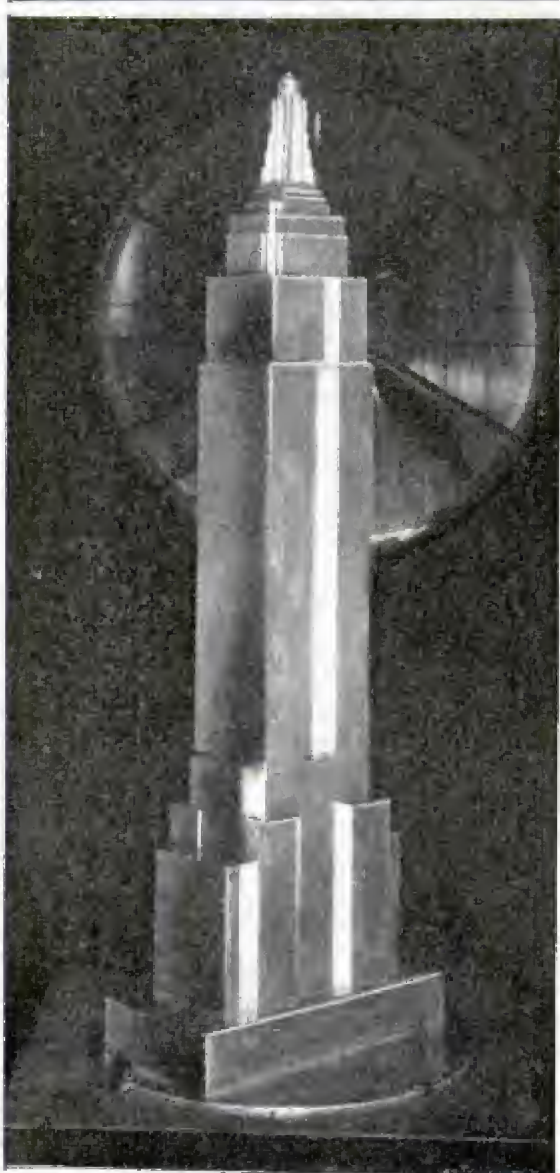
Operating on pulleys stationed at each end of the pool, an automatic timer for swimmers sets the pace with a flag traveling at any desired rate and at the same time records the number of lengths completed. It relieves the coach of his stop watch, and precludes guesswork by showing the exact pace at every stroke. The timing mechanism, electrically operated, may be set at speeds from fifty seconds for 100 yards to two minutes and forty seconds for 100 yards. It is adjustable to a tenth of a second for any distance within that range. Extremely slow speeds are used in training to teach rhythm and relaxation.

I met H. M. McCulley at the 1936 Olympic Swimming Coach, State College, Pullman, Wash.

TOPSY-TURVY



Top, building a section of giant de-icer for seventy-two passenger Boeing ocean flying boat. Left, model of Empire State building in ten-foot wind tunnel

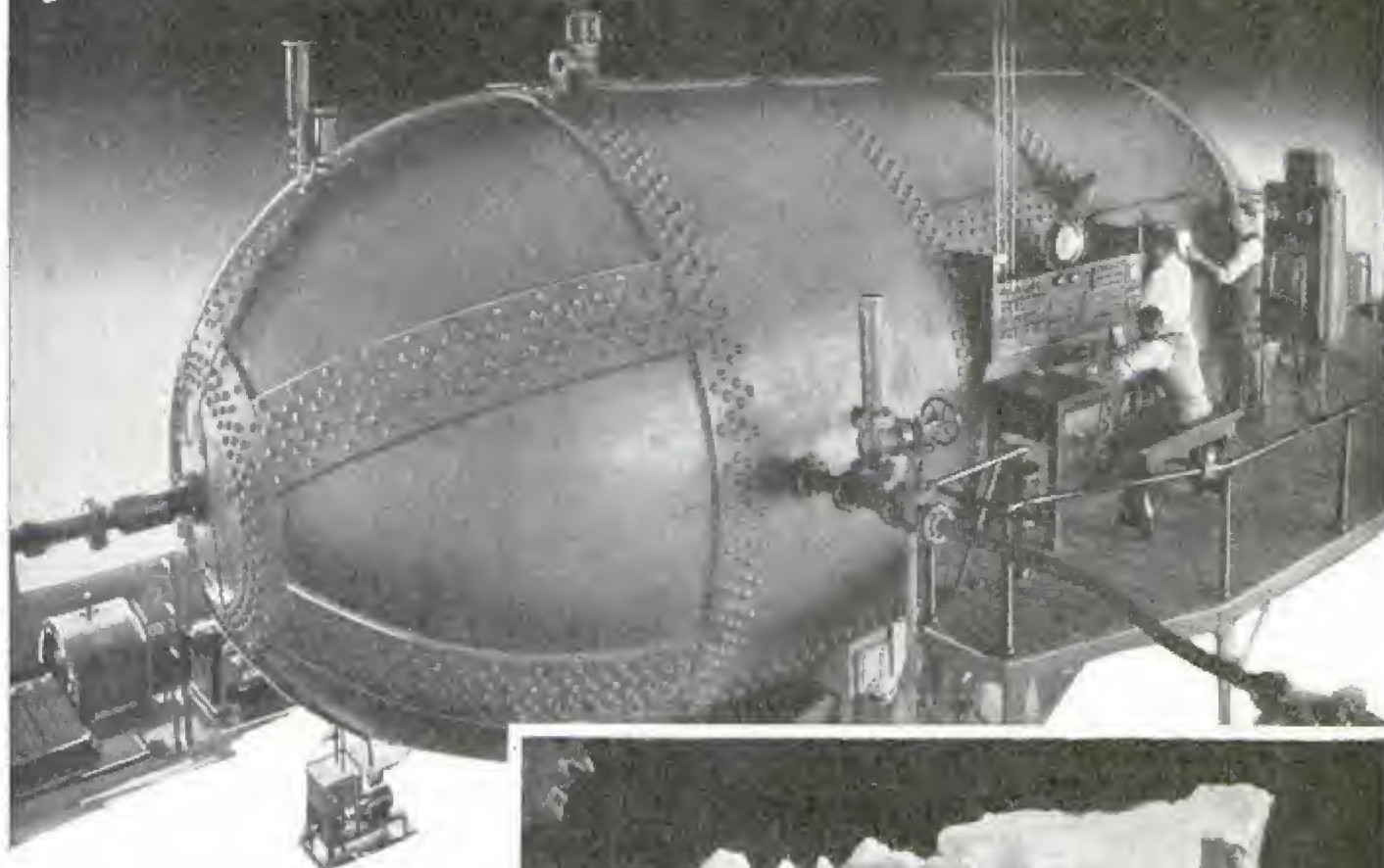


BLIZZARDS in August and heat waves in dead of winter; raging floods in lands stifled by drought; earthquakes and tidal waves that never find their way into headlines—

These are but a few of the topsy-turvy weather conditions created by modern Vulcans and Thors by the flip of a switch or the turn of a dial. They can simulate the furies and caprices of the elements on the moment's notice. Their magic makes possible the manufacture of better motorcars, safer airplanes and sturdier buildings, as well as enhancing our safety and comfort.

"Tailor-made" weather has been developed by research workers to determine the value of a given material or construction for a specific service. If automobiles are to meet extremes in weather conditions throughout their lives, they must prove their fitness in the cold rooms of motorcar builders' engineering departments. Temperatures as low as thirty degrees below zero and sixty-mile gales can be reproduced in Studebaker's weather plant. Checks on thermostatic heat and water controls, engines running under sub-zero conditions, and carburetion and ignition tests are made regularly, in addition to

Weather MAGICIANS



studies on such developments as the car's new air-conditioning and heating unit.

Remember the airplane of a dozen years ago? It was a crude, boxlike contraption with peculiar landing gear, square wing tips and a wealth of brace wire. The location and power of the engine were a mere guess, as was the design of the propeller.

Contrast such a ship with a modern Boeing, Douglas, or Lockheed.

What is responsible for the great gap between them? Is it the combined experience of pilots, air-line operators, chemists, engine builders, gained from the millions of commercial flying miles piled up since the early twenties? That's part of it, but the real reason may be summed up in one word, research. And aeronautical research calls for plenty of test-tube weather.



Top, variable density wind tunnel where research engineers study performance of scale models. Below, automobile frozen in block of ice

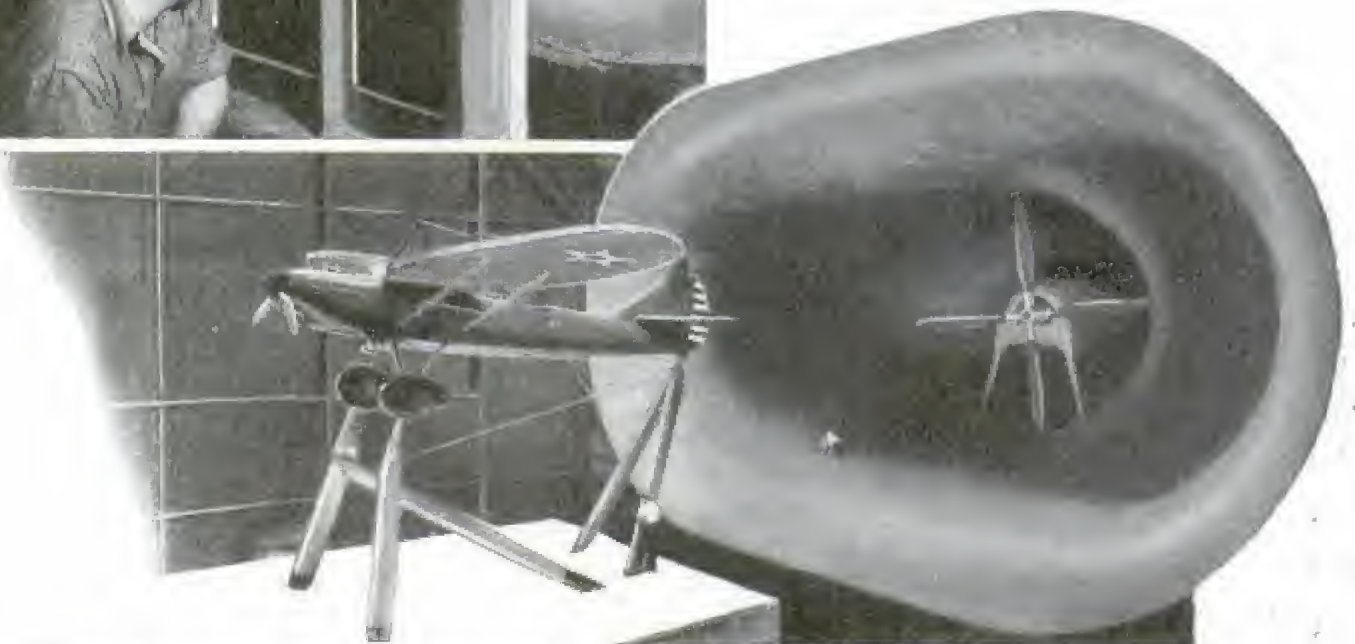
Ice formation on aircraft has given the air industry its biggest headaches. The danger lies partly in increased weight, but chiefly in the deformation of aerodynamic shapes; since it is from the wings' contour that the lifting factor is derived, it can be seen readily what a menace the ice film can become.

In all the years spent in developing



de-icing equipment, the engineers have had to manufacture their own weather for research. The biggest rubber de-icers ever made were put on Pan American's giant "Boeing 314," the seventy-two-passenger Atlantic clipper; but before 310 square feet of rubber could be converted into overshoes, model planes spent months bucking gales in a test chamber.

In Goodrich's storm room, largest of its kind in the country, water sprays, a cooling plant and blowers join forces to furnish tempests similar to those Pan American will have to cope with across the North Atlantic. The rubber mittens, standard equipment on commercial air lines, line the leading edge of wing and tail surfaces. Connected with a compressed-air pump, they expand and contract with regular pulsations, cracking the ice so the wind can strip it off. A wide variety of de-icers have been tested in this plant, each being subjected to different types of ice, from watery slush to hard rime ice of white crystalline structure. It has been found that the most violent breaking action is effected by a three-tube shoe, inflating first the center and then the two outer tubes.

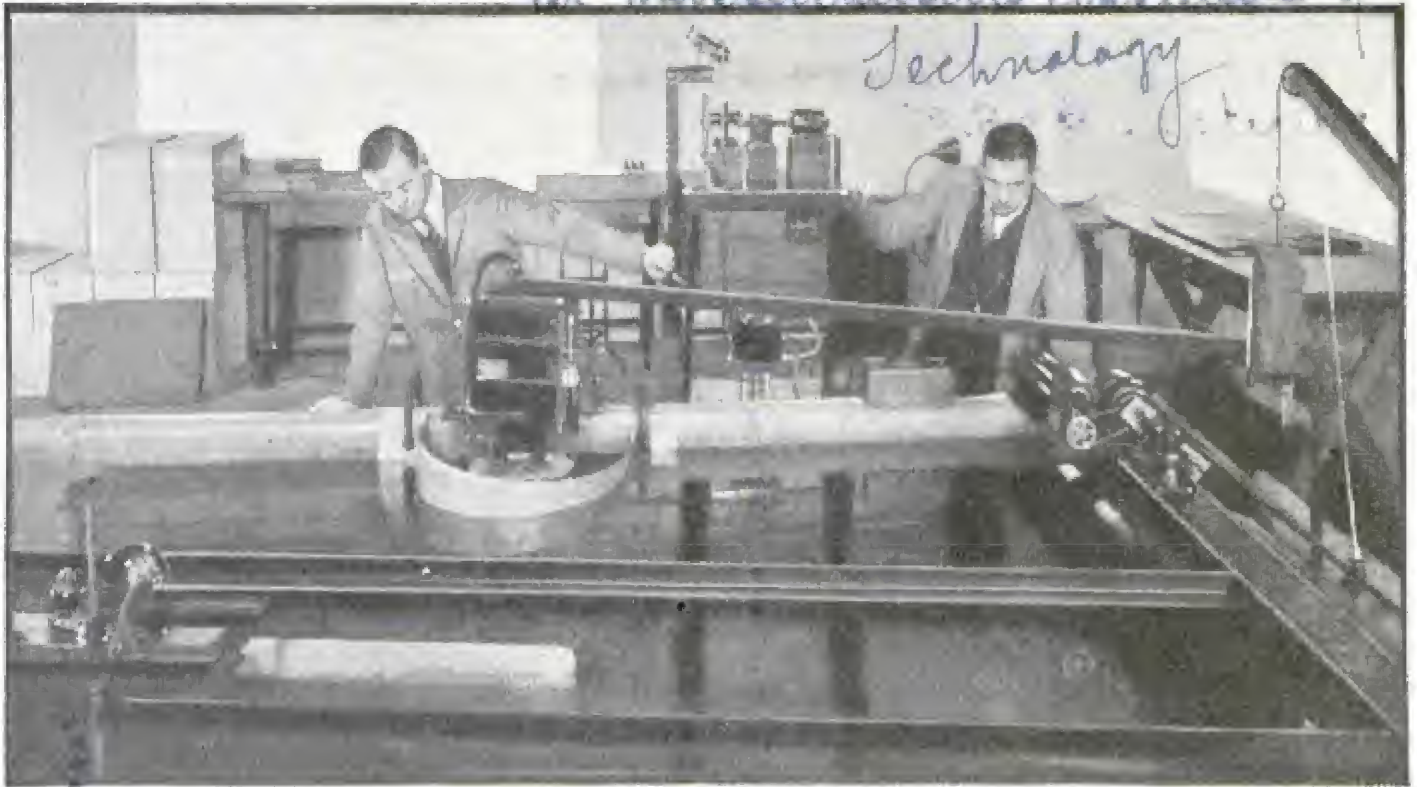


Seaplane hull models in upper two pictures are towed at high speed in experimental basin to determine water resistance. Below, watching "superflood" pass over model of Tygart dam spillway. Bottom, army plane ready for test in full-scale wind tunnel at Langley Field.

naca wind tunnel

J. Vargnes

Massachusetts Institute of Technology



The collective nightmares of air-line pilots could not churn up the variegated weather on tap at the laboratories of the National Committee for Aeronautics at Langley Field, Va. Its variable-density air tunnel is one of the outstanding scientific pieces of equipment in the world. Only in this type of wind tunnel is it possible to use small models for obtaining full-scale results. The tunnel is constructed within a steel tank and compressed air is used to test the miniature. If, for example, a one-twentieth scale model airplane is tested, the air is compressed to twenty times normal density, or 300 pounds per square inch.

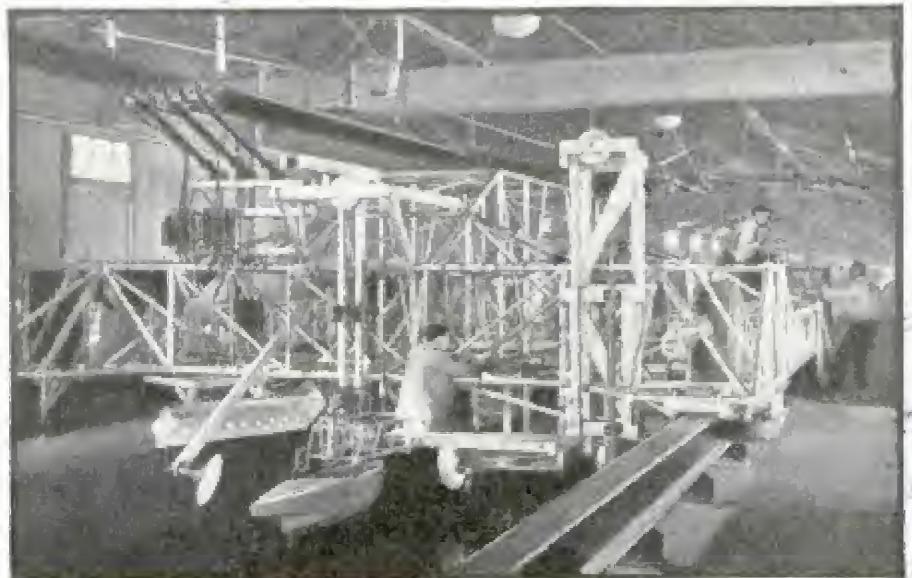
Kingpin among the fifteen wind tunnels at Langley Field is 434 feet long, 222 feet wide and ninety-seven feet high. The air stream is thirty by sixty feet with a velocity from twenty-five to 118 miles an hour. The diameter of the propellers is thirty-five feet five inches.

Ask the average person what he knows about the science of seismology and he will tell you it is concerned solely with the

recording of earthquake motions. Registering wave motions is indispensable to earthquake study, but it is only a means to an end. The geophysicist uses seismographs to find out what he can about the interior of the earth and the causes of earthquakes; the engineering seismologist studies seismograms to learn the effects of earthquakes on buildings.

The scientist working in this latter branch, instead of recording the motions of an earthquake, takes a record of an actual earthquake shock, then reproduces it

(Continued to page 122A)



Top, electrical tide-maker in model of Cape Cod canal. Bottom, view of experimental tank with miniature flying-boat hull mounted for test tow

Electric Grinder for Knives Gives Uniform Edge



It takes little time to keep knives sharp with this electric grinder that puts on a keen edge quickly

Flip a switch, pass a knife through the slot, and an electric grinder puts a keen, convex edge on the blade regardless of how the knife is inserted. Entirely inclosed in a streamline hood, the power unit drives four abrasive blades that grind at a speed of 10,000 strokes per minute, giving a uniformly sharp edge the full length of the blade. The grinder will not burn or weaken the temper of the knife.

Four-in-One Safety Fuse Plug Changes Automatically



If you blow a safety fuse with an automatic changer, another takes its place in five seconds. If a defective electric appliance has caused the trouble, this five-second lapse allows time to pull it out before the

lights come on again. The new safety fuse will change automatically three times in the same manner, and when the fourth fuse burns out the lights flicker on and off to indicate that the unit should be replaced. In the event of a severe short circuit, however, the flickering also will cease. Inside the unit a contacting pin, mounted on a shaft rotated by a coil spring, engages the fuse metal. When the first fuse burns out, this pin by-passes it and turns to the next one. After the fourth has burned, the contacting pin meets the flicker fuse which will not blow out unless there is a severe short in the system. The lapse of time between fuse changes is controlled by the tension or a binder pin against the shaft.

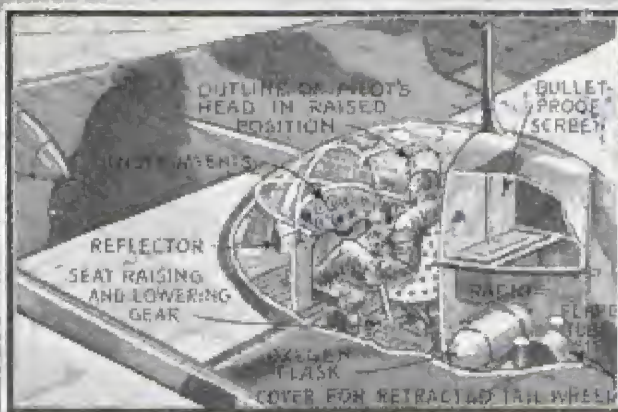
Runner Cannot "Jump the Gun" Equipped with Ground Plate

Jumping the starting gun in a foot race is impossible with an electrical apparatus demonstrated at the Amateur Athletic Union convention. If the runner lifts his hand prematurely from the pad, electrical contact with the gun is broken, preventing it from being fired.



Gun will not fire if the runner breaks the electric contact by lifting his hand from the pad too soon

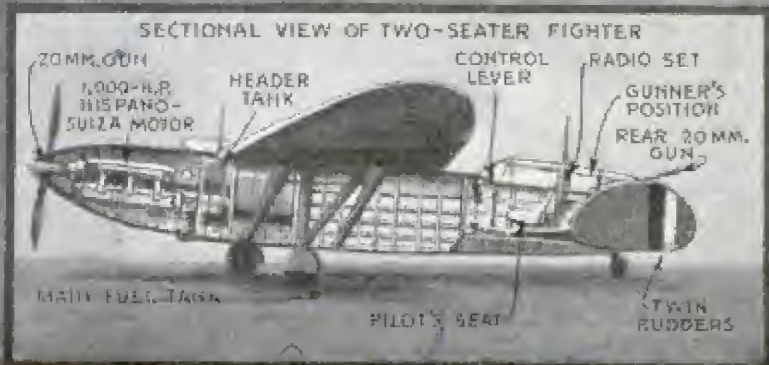
Pilots Sit in Tails of Latest Fighting Planes



SIDE-VIEW OF SINGLE-SEATER FIGHTER



FRENCH DELANNE, TWO-SEATER FIGHTER—SPEED 370 M.P.H.



Here are two of the latest fighting aircraft. Top, the British single-seater has wide visibility and its pilot sits in the tail. Below, the French two-seater has pilot and gunner sitting in the tail. Its armament includes shell-firing cannon. Both ships are fast, the French plane being rated above 370 miles per hour.

Airspeed Factory, Portsmouth, England

Delanne, two-seater

Tandem Bikes Are Coupled Making Striking Float



Four of the riders supply all the power needed to propel this float made by combining two tandems

Two tandem bicycles have been coupled together to form an easily maneuvered float for use in parades. Mounted on a bracket between them is a single bike to carry an extra rider. Motive power is supplied by four persons astride the tandems. Fully loaded with riders, radio and decorations, the float weighs about 800 pounds.

Electrons Bouncing Off Metal Predict Surface Wear

Long sought because of its importance in almost every phase of engineering, an electronic method of predicting the wear of metals in rails, bearings and other machine parts has been found by research engineers of Westinghouse Electric and Manufacturing company. The electron is well adapted to studies of mechanical wear, because, unlike X-rays, it is easily deflected by the atoms in any material it strikes and penetration is limited to the surface layers. In practice a beam of electrons moving at a speed about half that of light is bounced

off the surface under examination, and the direction of the diffracted rays leaving the surface is recorded photographically. The structure of the surface may be determined from this pattern.

Automatic Timer for Darkroom Works Like Dial Phone

Both hands are left free for "dodging" and careful control of the printing when a photographer uses an automatic darkroom timer that dials the number of seconds



exposure. Operated like a dial telephone, this timer is cut in on the light circuit of the enlarger. After focusing, you dial the number of seconds and the light is automatically turned on for the proper interval.

Pedal Converts the Bathinette into Baby's Dressing Table

Converting the baby's portable bath into a dressing table is done by a foot pedal on the latest models. Without taking her hands from the baby, the mother steps on the pedal and a canvas frame is drawn over the rubber tub and locked in place.



Stepping on foot pedal brings canvas table over baby's bathtub and locks it in that position

Baby Bathinette Corp.

programs you wish to hear. If the set is operating it can be turned off by merely pressing a button; to cancel all previous station settings it is only necessary to swing the clock finger dial to the left. The set can be operated directly by pushing buttons on the dial, and the clock does the very same thing by closing switches inside.

clock face.

Isalvin Infy Corp 417
1101 5th St. Des Moines, Iowa

1939 LITTLE GIANT *Portable*



By Frank M. Lund

THIS improved model of the most popular portable t.r.f. broadcast receiver ever described for construction in Popular Mechanics Magazine, is now a combination phonograph and 4-tube a.c. set with 5-watt output. There are several good reasons for the popularity of this particular tuned-radio-frequency receiver circuit; it makes an excellent inexpensive

general-purpose portable broadcast set that is easy to build, has distance-getting ability, adjustable tone control and surprising volume. A beam-power tube in the final stage of the new model provides ample output for a 6-in. dynamic speaker and the volume is all that could be desired for both radio and phonograph-record reproduction.

Easily portable and all a.c. in operation, it can be used wherever a 110-volt, 50 to 60-cycle line supply is available. The phono-radio combination provides entertainment and dance

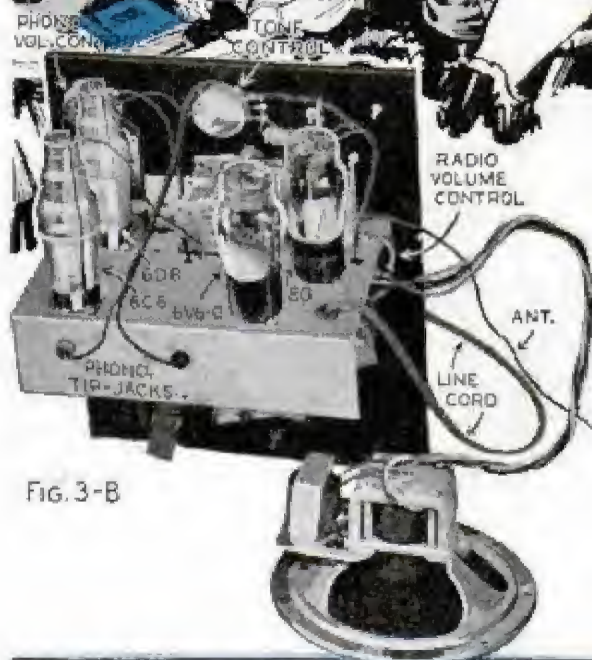


FIG. 3-B

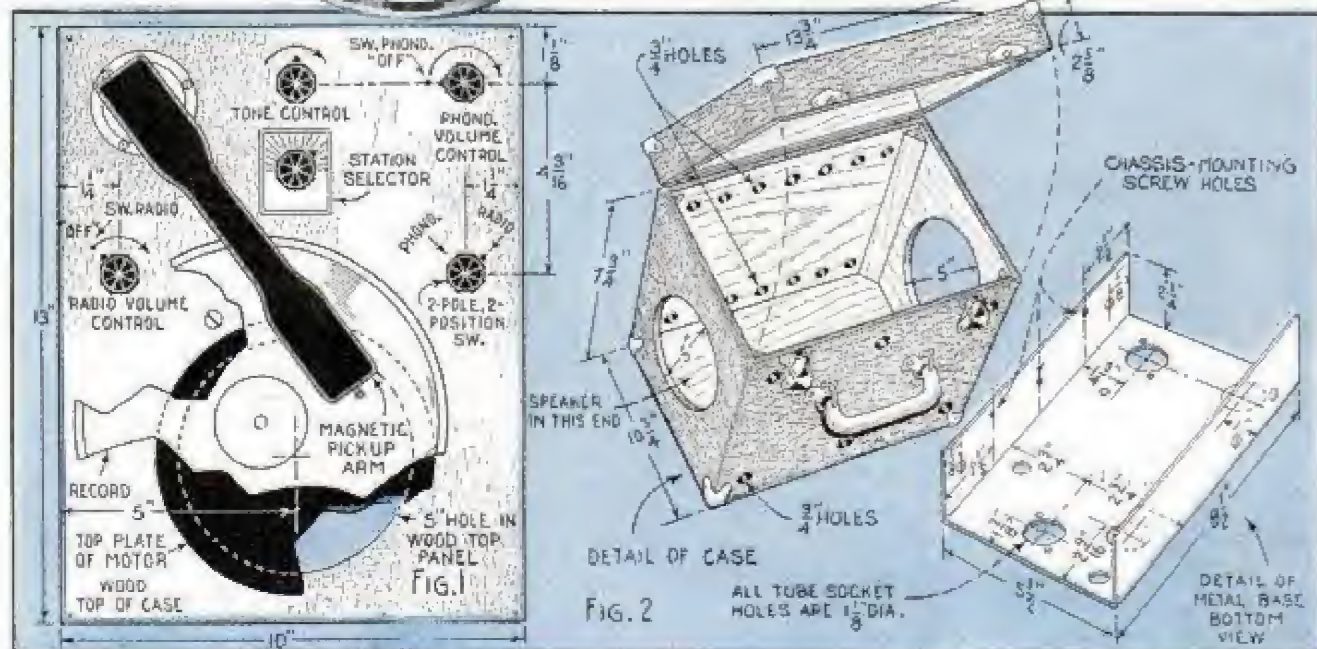


FIG. 2

T.R.F. PHONO-RADIO

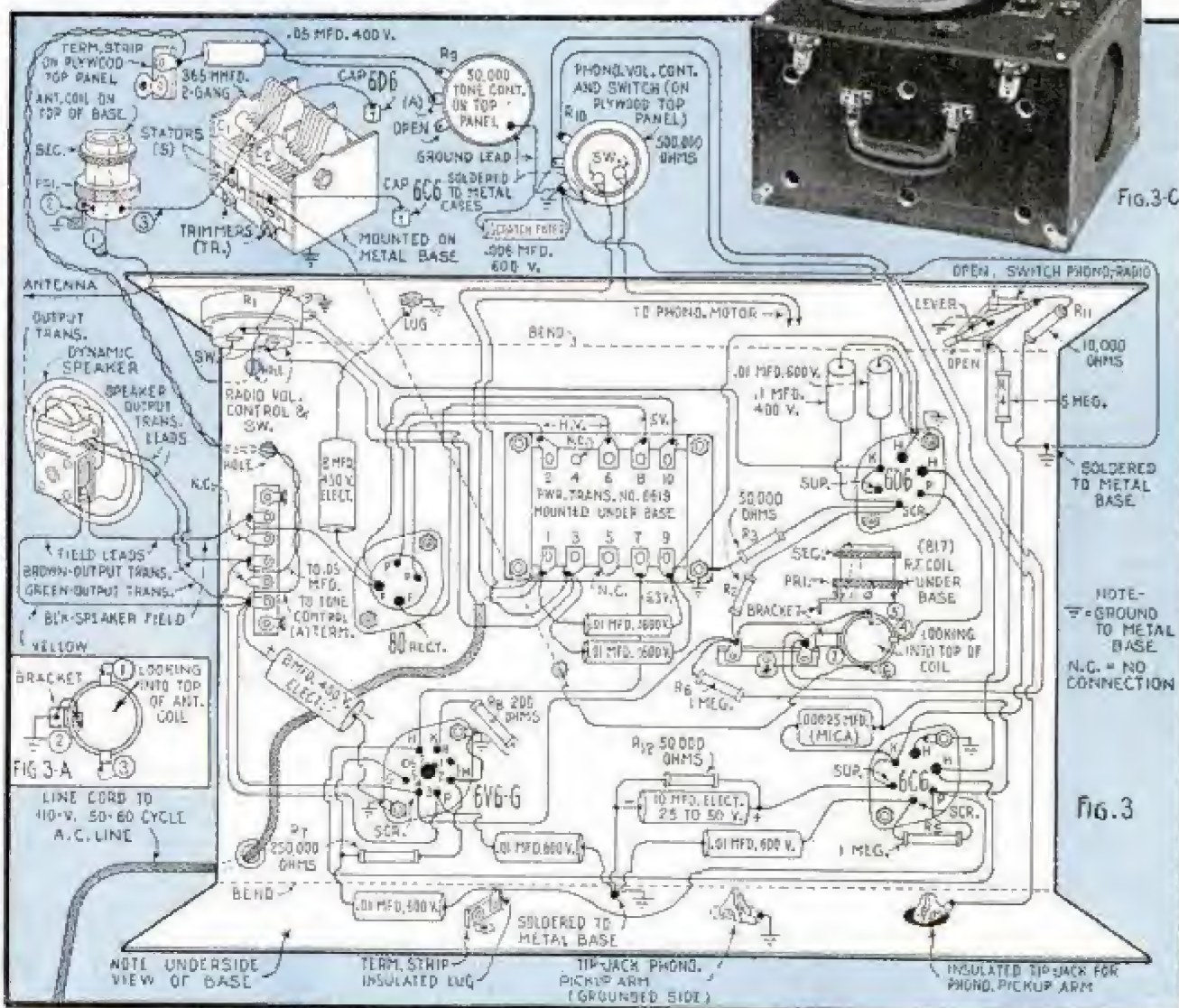
music for small groups in locations where large receivers would not be practical, and phonograph records may be played and amplified when broadcasting stations leave the air. Complete in every detail, it weighs only 16 lbs., and operates on a 20-ft. antenna.

Readers who built former models of the receiver will note that the same types of antenna and r.f. coils are employed, the main changes being in the output stage and the power transformer which replaces the line-cord resistor. This transformer furnishes power for the self-starting induction-type phono motor and the radio set. The phono motor is provided with an 8-in. felt-covered turntable, which turns at a constant speed of 78 revolutions per minute, and plays all sizes of commonly used records.

(Continued to page 136A)



FIG. 3-C



RADIO HINTS

Extension speaker of "universal" type installed in kitchen by means of an insulated single-wire line from plate terminals of output-tube sockets in receiver; circuit is completed by connecting ground post of set, and extension speaker to a cold-water pipe. Speaker-housing details in Figs. 1 and 1-A. Fig. 2, hookup for single tube

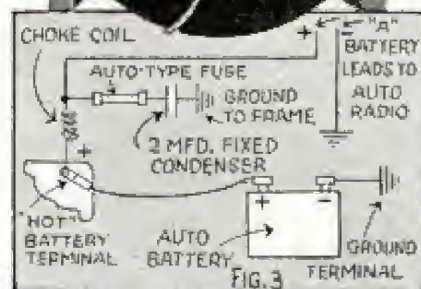
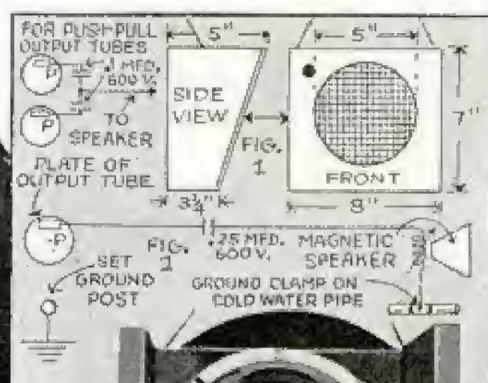
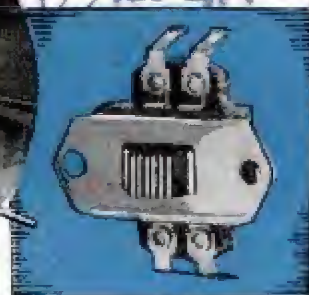
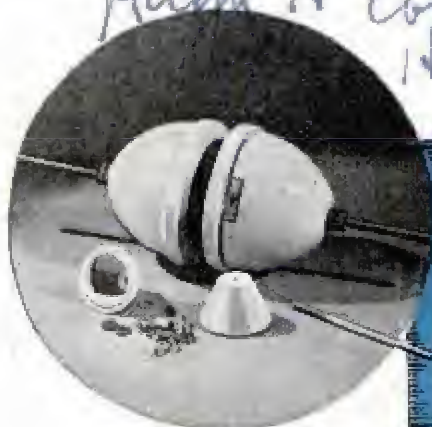


Diagram Fig. 3 is an effective method for eliminating ignition interference in an auto set when all other means such as shielding and suppressors fail. Choke is made by winding from 25 to 50 turns of No. 14 double-cotton-covered wire on a form $\frac{1}{2}$ in. in diameter and about 3 in. long. Fuse prevents shorting battery if blocking condenser fails. Lower left, Steatite bushings for bringing high-frequency voltage through partitions; small ones are also used to support coils. Right, slide switch useful for tone controls or change-over circuits. Fig. 4 illustrates a safe method for grounding receivers of the a.c.-d.c. type which have no ground posts or provision for a chassis ground. A .5 mfd. paper-type condenser is connected in series with a lead fastened under a screw on the chassis base, the other side of the condenser being attached to a ground clamp on a cold-water pipe.



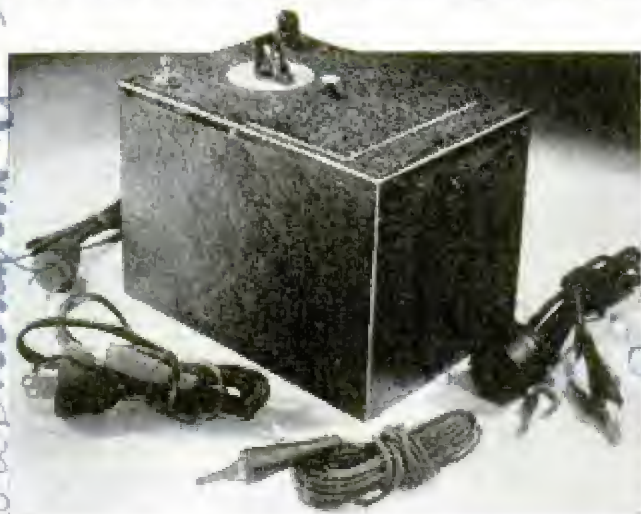
Portable Set Is Self-Powered



No antenna or ground wires are required for this self-powered battery-operated receiver as the antenna wire is built into the set itself. The dry-cell "A" battery will serve for 250 playing hours before replacement is necessary. Broadcast receivers of this description are suitable for sportsmen, vacationers and travelers away from power lines.

Line Noise Analyzer Saves Time

Connected between the noise-producing electrically operated appliance and power line, or between the radio receiver and



line, various forms of noise-filter arrangements can be tried out quickly by merely rotating a selector switch on this compact portable device. Attachment cords and connectors provide for test connections and grounds. When noise is reduced to a minimum, the analyzer indicates the standard type noise filter to use in duplicating the same setup, thus eliminating guesswork and loss of time.

All-Purpose Mobile Sound System

Operating either from a 110-volt a.c. line or a car battery, this versatile public-address system is suitable for street-corner, mobile or indoor applications; its 30-watt normal output is ample for good-sized crowds. It consists of a 9-tube ampli-



fier in a steel carrying case and two 12-inch permanent-magnet loud speakers with aluminum dome baffles. The unit includes a phonograph turntable and pickup, generator for battery operation and receptacles for speaker, microphone and power plugs.

Blueprints covering radio construction articles in this and past issues are available for 25 cents each; original material lists and additional information can be obtained from our Radio Department without charge upon receipt of postage.

NEXT MONTH—How to Build a Low-Cost Progressive Three-Unit Broadcast Receiver. Designed especially for student beginners; employs three of the latest 1.4-volt tubes; works on one No. 6 dry cell and two 45-volt midget B-batteries. Also—**How to Operate Up to Twenty Receivers on a Single All-Wave Antenna**

Philco Radios & Television Corp.
 3701 N. Broad Philadelphia
 Aerovox Corp. 70
 Washington D.C.

Ignatius Repair
 Service & Co.
 100-6th Ave New York



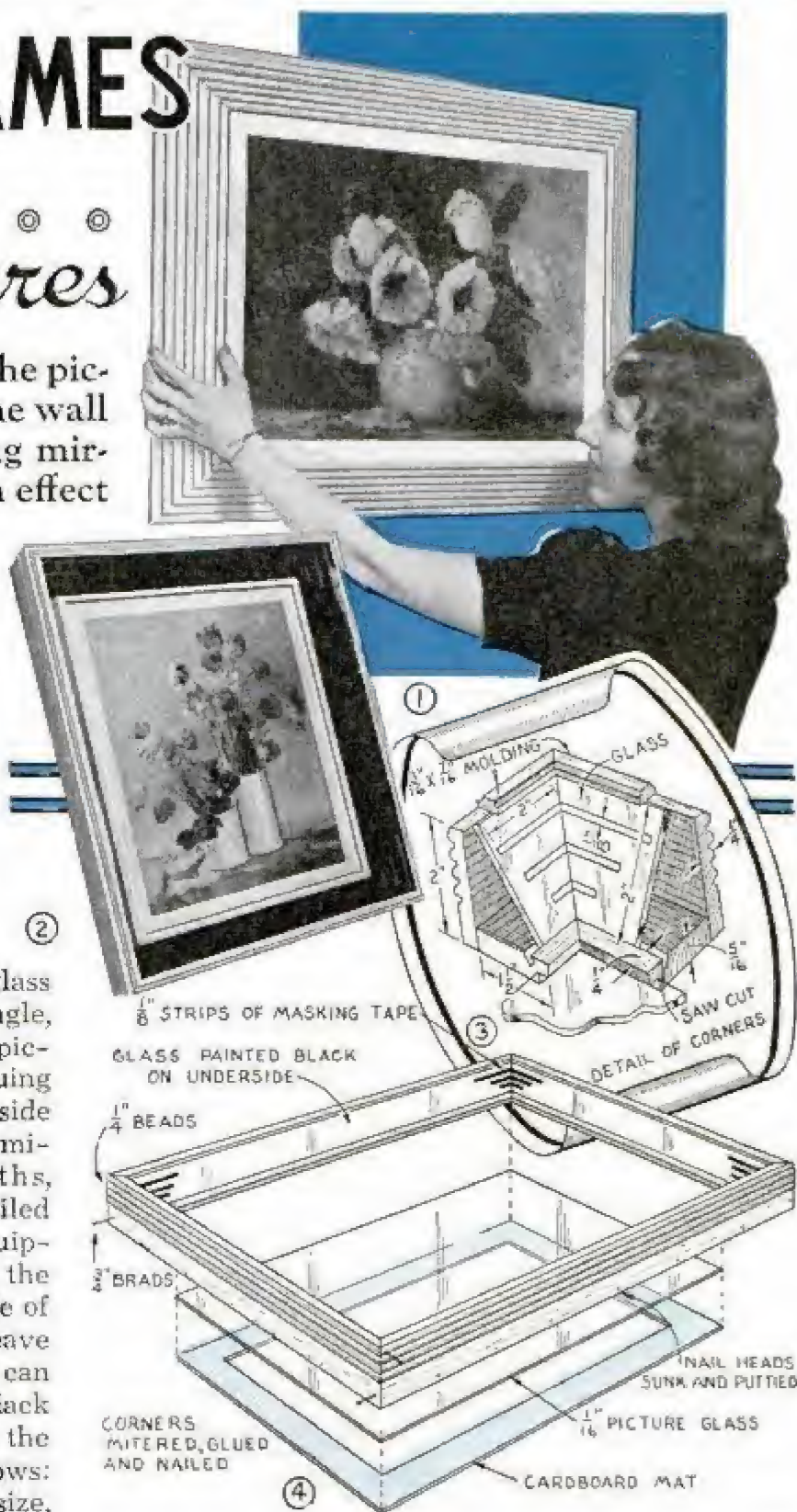
NEW FRAMES

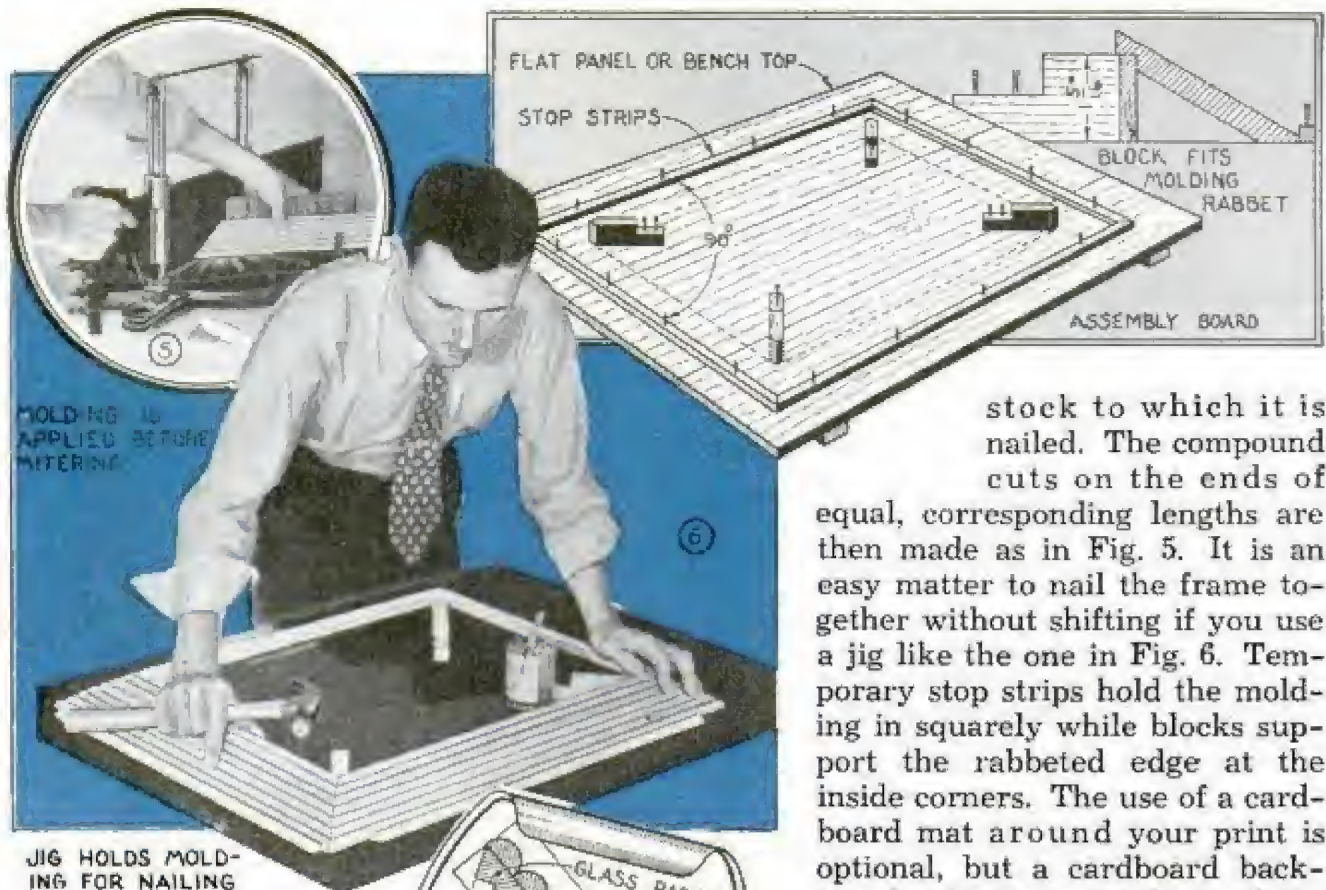
for your pictures

Two types—one raises the picture in relief out from the wall while the second, having mirrored sides, gives sunken effect

By W. C. LECKEY

MOUNTED in either of these two stunning frames your pictures will stand out strikingly among modern furnishings. The molding for the frame pictured in Fig. 2 is cut and assembled as shown in Figs. 3 and 4, from strips of white pine. The saw groove for the glass inserts, which is cut at a 60° angle, and the rabbeted edge for the picture glass are cut before gluing and nailing to the beaded side pieces. Then the molding is mitered to corresponding lengths, after which it is glued and nailed together at the corners. If equipment is not at hand to run the 1/4-in. beads around the outside of the frame, Fig. 4, you can leave this plain. For the inserts, you can select either silver, blue or black mirror glass. You can make the latter from clear glass as follows: After the glass has been cut to size,

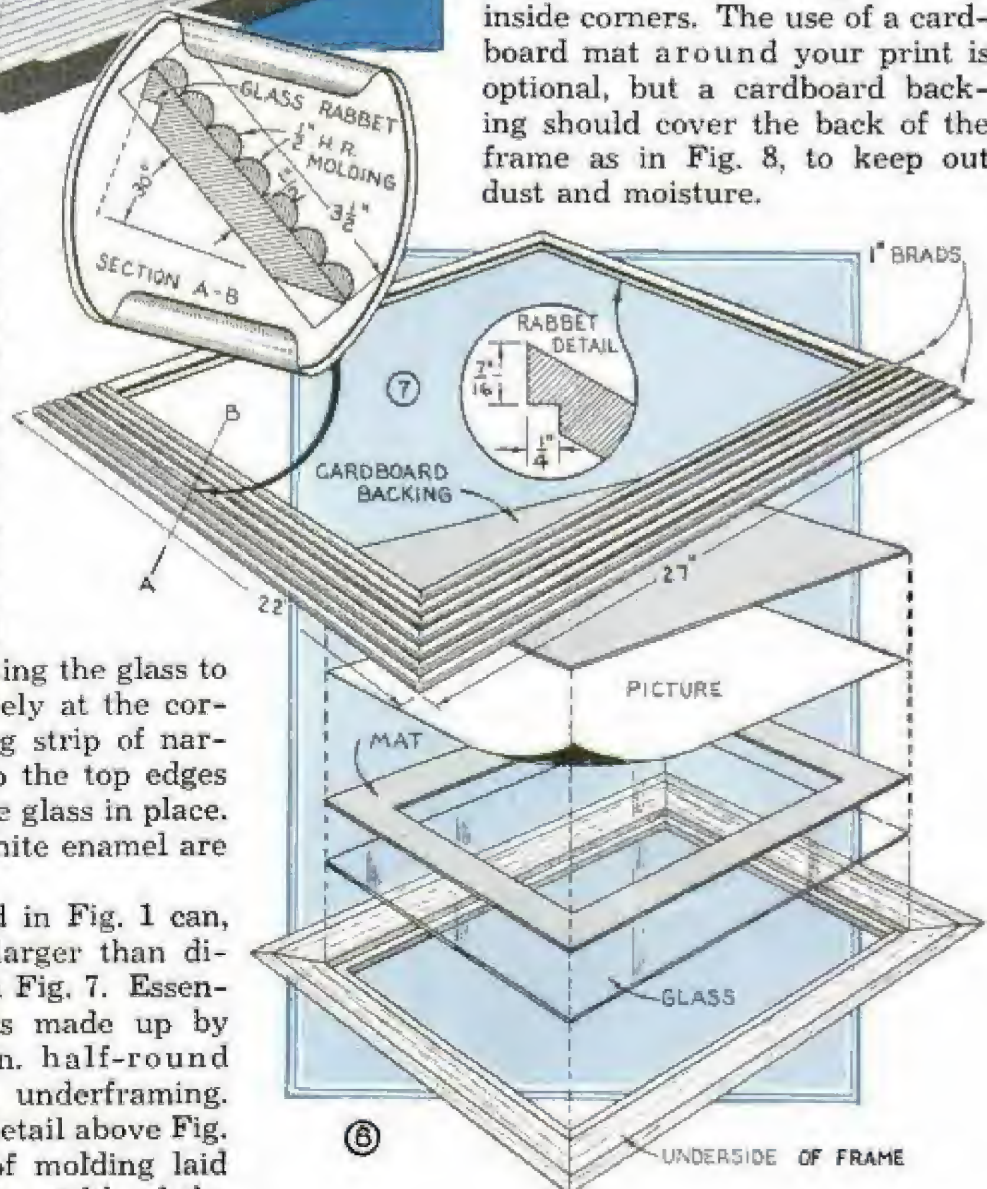




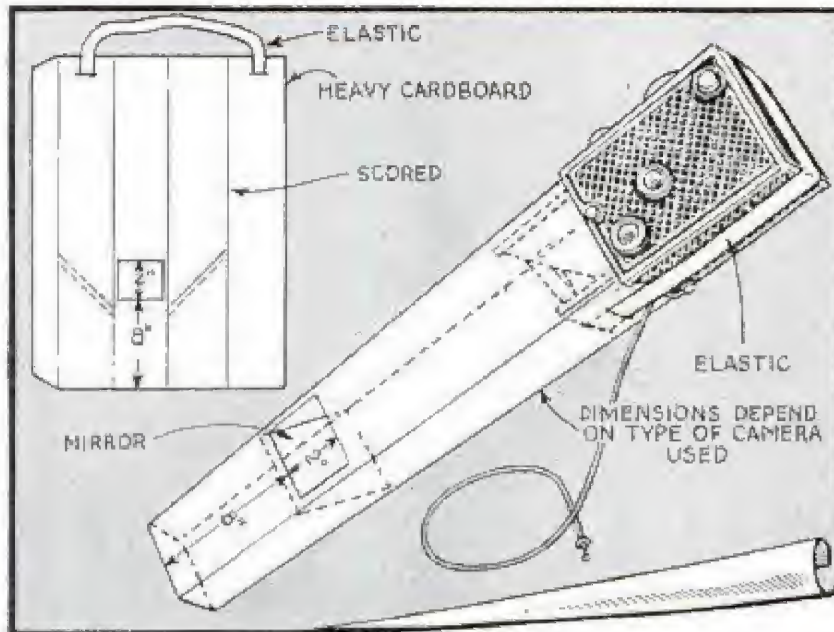
apply strips of masking tape to corners on the underside as in the suggested pattern. Then give the underside two coats of black enamel. When dry, cut around the masking tape carefully with a razor blade, remove the tape and fill in with gold paint. A template of cardboard will be helpful in cutting the glass to butt together accurately at the corners. An overhanging strip of narrow molding glued to the top edges of the frame keeps the glass in place. Two coats of bone-white enamel are then applied.

The frame pictured in Fig. 1 can, of course, be made larger than dimensions indicated in Fig. 7. Essentially, this frame is made up by gluing strips of $\frac{1}{2}$ -in. half-round molding to a $\frac{1}{2}$ -in. underframing. You will note in the detail above Fig. 7 that seven strips of molding laid side by side equal the width of the

stock to which it is nailed. The compound cuts on the ends of equal, corresponding lengths are then made as in Fig. 5. It is an easy matter to nail the frame together without shifting if you use a jig like the one in Fig. 6. Temporary stop strips hold the molding in squarely while blocks support the rabbeted edge at the inside corners. The use of a cardboard mat around your print is optional, but a cardboard backing should cover the back of the frame as in Fig. 8, to keep out dust and moisture.



Camera Elevated Above Crowds by Periscope



Photographers who favor small reflex cameras, which are of little use in a crowd or other places where objects interfere with waist-high aiming of the lens, will find that this simple periscope solves the problem. It consists of a rectangular tube and a small mirror. Heavy cardboard or other suitable rigid material may be used for making the tube. The upper end fits the camera focusing hood snugly to exclude light, and the tube tapers slightly

toward the lower end. About 8 in. from this end, a small mirror is set at a 45° angle behind a 2-in. opening in one side of the tube. Small wood strips glued to the inside support the mirror. Any object showing on the camera ground glass is visible on the mirror through the opening. An elastic band fastened to the tube holds the camera in place. The shutter can be operated with a string, although a 2-ft. cable release is preferable.

Paint Burned Out of Empty Pail Without Damaging Metal

Large paint pails, which are often made of steel, provide handy containers around the farm or shop when cleaned inside thoroughly. To do this easily, first scrape the inside to remove as much paint as possible. Then set the pail in a tub of water with a weight in the bottom to hold it down, and drop a lighted newspaper inside. The paint residue will ignite and burn away entirely without melting soldered joints. Water surrounding the pail protects it against excessive heat.

White-shoe cleaning paste of the type that comes in tubes is a good substitute for white poster paint; when thinned with water, it is efficient and is less expensive than regular poster paint, especially when used in large quantities, or to cover large surfaces.



Clothesline Support of Pipe Is Neater Than Wood



Disliking the appearance of a heavy wooden post to support a clothesline, I made some supports from $\frac{3}{4}$ -in. pipe. Each one consists of three pipes assembled in a triangular shape and fitted together at the top by means of elbows, tees and nipples. The bottom of each support is set in a sunken nail keg, which is filled with concrete to anchor the pipes.

—C. M. Lyman, New Hartford, N. Y.

Dispenser Measures Polish



To obtain uniformity in polishing ferrotypes, a photographer uses a bottle which automatically measures the exact quantity of polish required each time. A glass tube, such as a sipper, is cut off so that it holds ex-

actly the amount of polish required for each tin. Then the tube is bent at the lower end and inserted into the bottle stopper so that it just clears the bottom of the bottle. When the latter is tipped up, the amount of liquid contained in the sipper is poured onto the ferrotypes.

Tin Cans Containing Small Parts Easily Identified

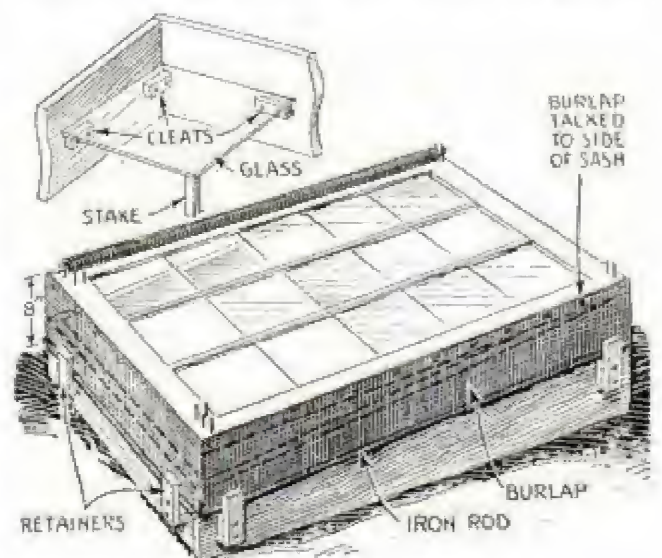
As cans used for storing small parts, nails and screws in the workshop are not transparent like glass jars often used for this purpose, one worker attached a sample of the contents on the outside. Some small items were fastened directly to the can with a drop of solder while larger items such as bolts were slipped through wire bent to form loops and soldered to the can. The samples can be removed readily, are easy to see and measure quickly, and the arrangement saves considerable time.



—Arthur M. Chester, San Diego, Calif.

Seedlings in Hotbed Shielded from Drip and Chill

In glass-covered hotbeds and cold frames, delicate seedlings are often beaten down or rotted by the constant drip water caused by moisture condensing on the underside of the glass. The use of a separate



pane of glass mounted inside the frame, as shown in the upper detail, ends the nuisance. The inner glass remains at the same temperature as the confined air and will not sweat. As ventilating glass-covered frames are not always practical during cold or windy days, due to sudden chilling of seedlings, the sash may be raised from one to several inches, by using a burlap curtain as shown in the lower detail. Then the escape of warm air and entrance of cooler air are retarded, thus bringing to the seedlings a gradual change of temperature. The top edge of the curtain is tacked to the sash and a hem at the lower edge of the curtain incloses a rod or pipe to serve as a weight. Cleats on the frame keep the curtain in position.

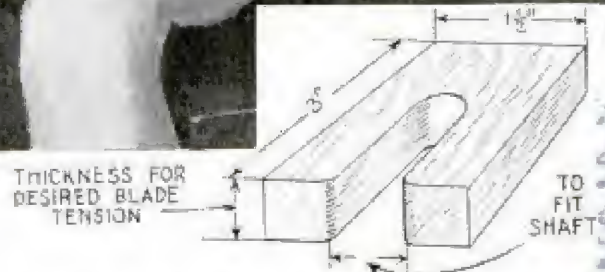
—Robert Stahler, Portsmouth, Ohio.

Bridge from Old Car Frames

A pedestrian bridge in a Nebraska state park is supported on old car frames, which have been stripped down and placed on end. The cross member of each carries steel rails, which support the bridge planks. The frames extend well above the walk proper so that guard rails are installed easily.



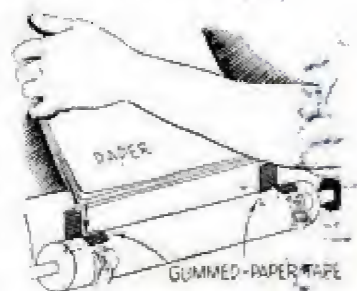
Changing Jig-Saw Blade Is Easy with Block of Wood



Users of jig saws who have wished for an extra hand when changing a blade, will find that a block cut as indicated will hold down the spring-loaded shaft, leaving both hands to insert the blade and tighten the locking screw. Thickness of the block will depend on how far the shaft must be lowered to get the required tension on the blade.—Ralph T. Moore, Lakewood, Ohio.

Paper Tape Guides on Typewriter Aid in Manifold Work

Difficulty in typing a number of sheets of paper with carbons between them caused me to experiment with guides of gummed-paper tape stuck to the typewriter roller as indicated. The tape was folded and creased so that half the length of each piece was free, forming a V into which the sheets and carbons were dropped before turning the roller to bring them into typing position.

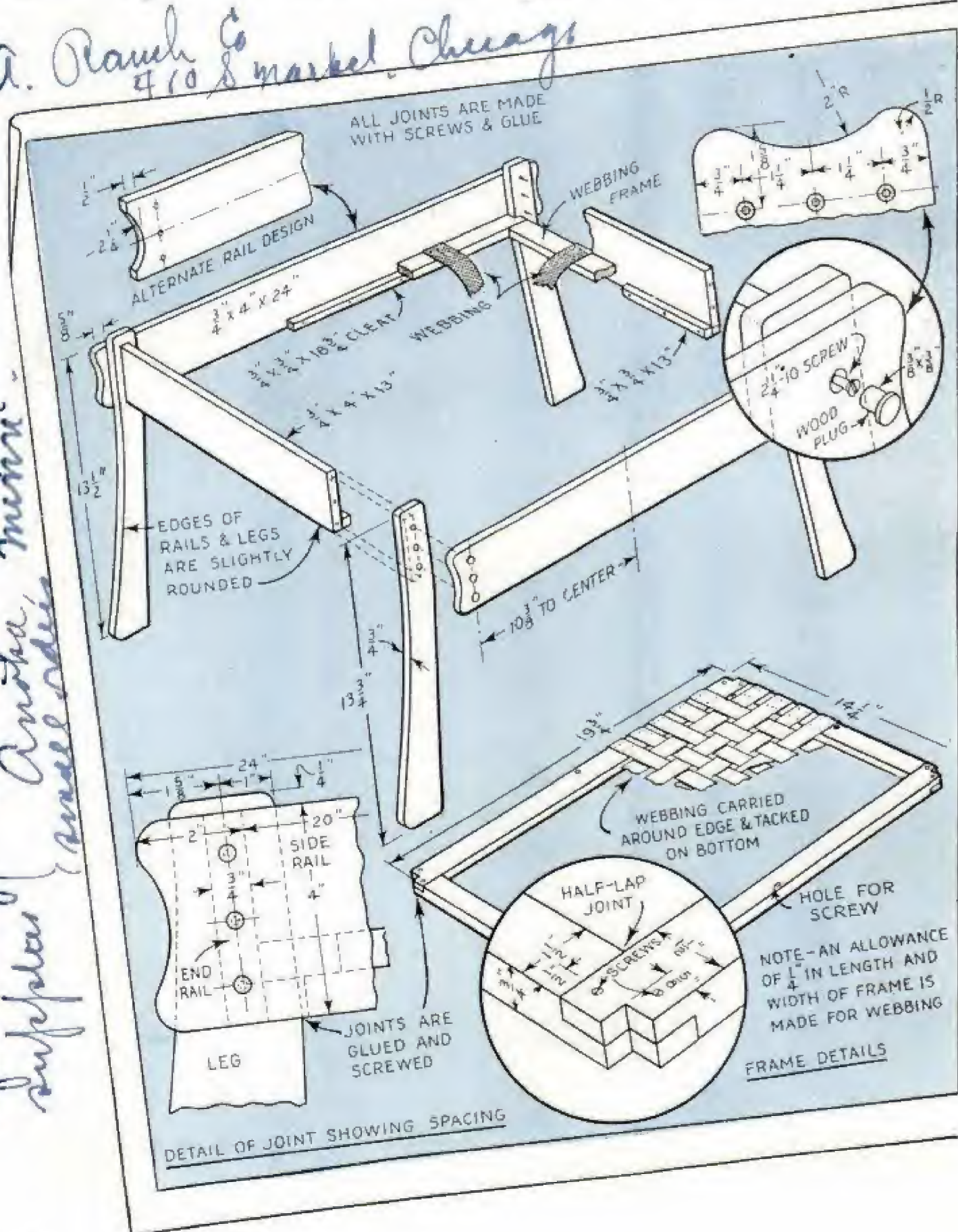


—G. E. Hendrickson, Argyle, Wis.

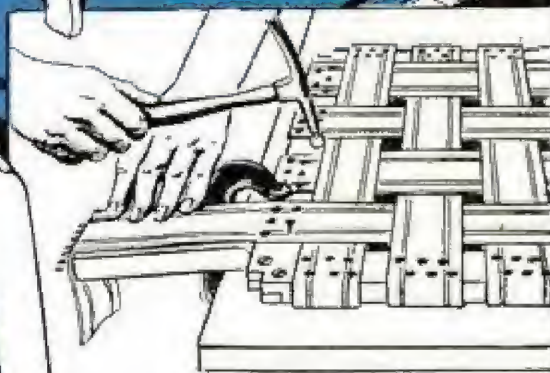
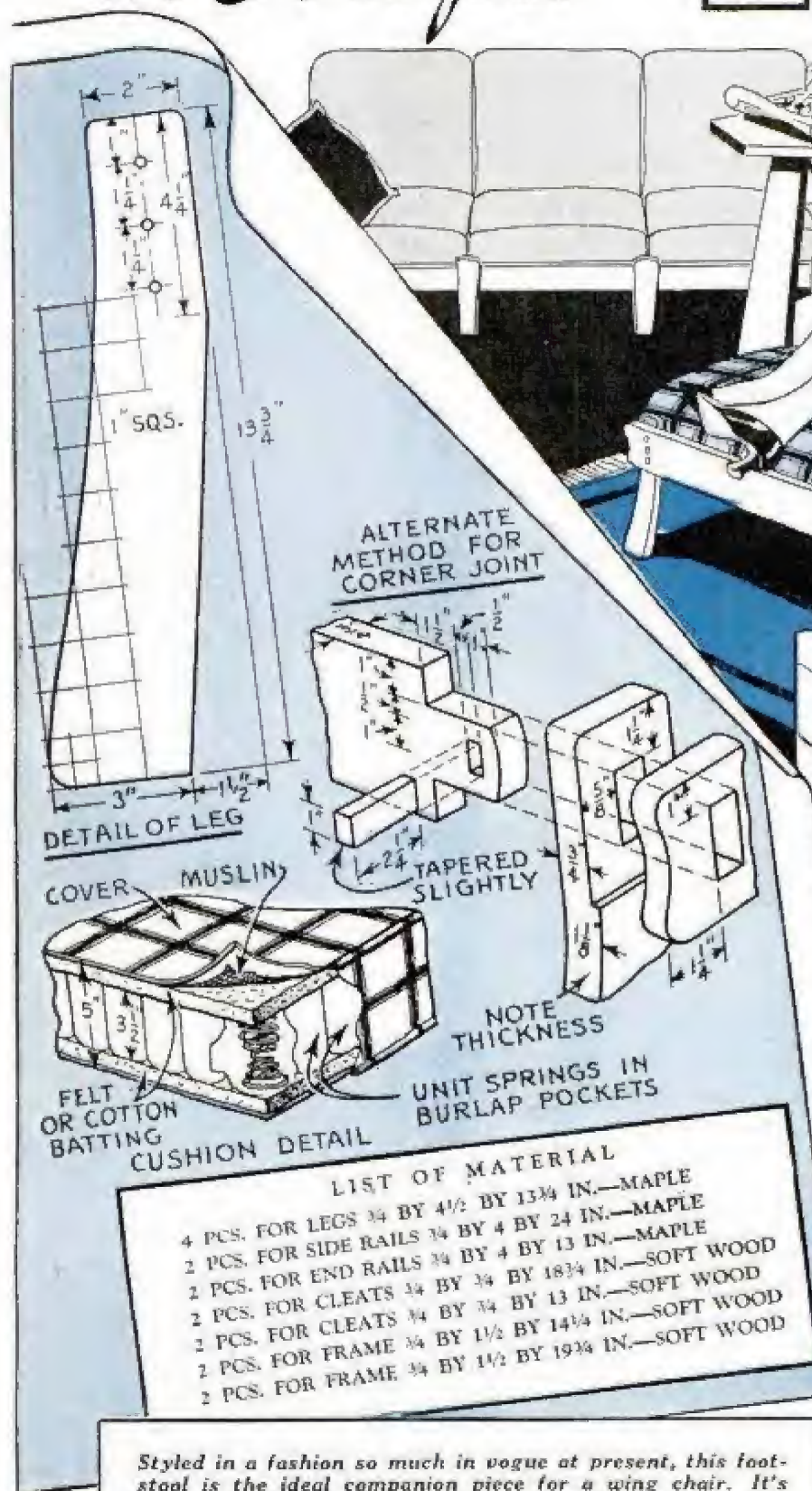
A Pioneer FOOTSTOOL

2^d A. Ranch Co. Market Chicago

upholstery (Thurston Supply Co
supplies (Anoka, Minn.
small order



in Maple

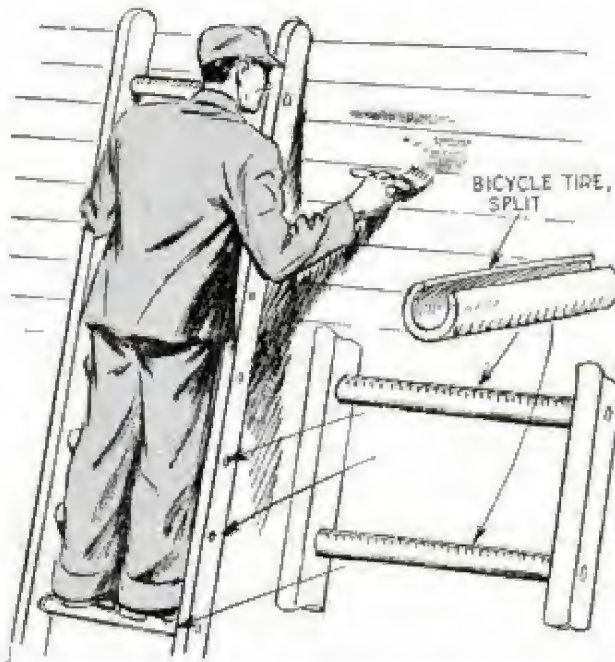


HALF-ROUND FILE

END DESIGN IS SAWED, THEN SMOOTHED WITH HALF-ROUND FILE

Styled in a fashion so much in vogue at present, this footstool is the ideal companion piece for a wing chair. It's comfortable too, when used individually as a fireside seat, or as a radio bench. Simplicity of construction makes it an easy job for the craftsman who has only a few tools and limited spare time. The cushion spring unit can be obtained ready-made at a nominal cost and the work of covering it to make an attractive, removable cushion is a simple upholstery job.

Non-Slip Surface for Rungs on Ladder



Danger of slipping while standing on a ladder, when your shoe soles are wet or muddy, can be reduced to a minimum by covering the rungs with pieces of old bicycle tires. Just slit the pieces on the underside and slip them in place. If the diameter of the tire is too large for the rungs, cut a strip from the underside.

—R. Moffatt, Brooklyn, N. Y.

Smoothing Inside of Wood Rings on Belt Sander

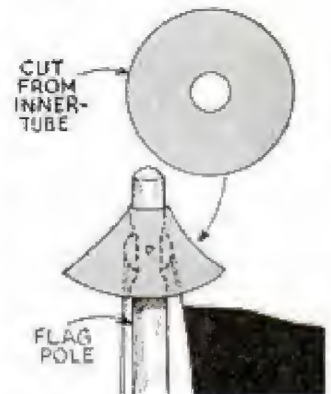
To sand inside surfaces of large wood rings on a belt sander set the ring on the belt, hold sandpaper against the inside surface of the ring, as shown, and start the machine. This rotates the ring, with the



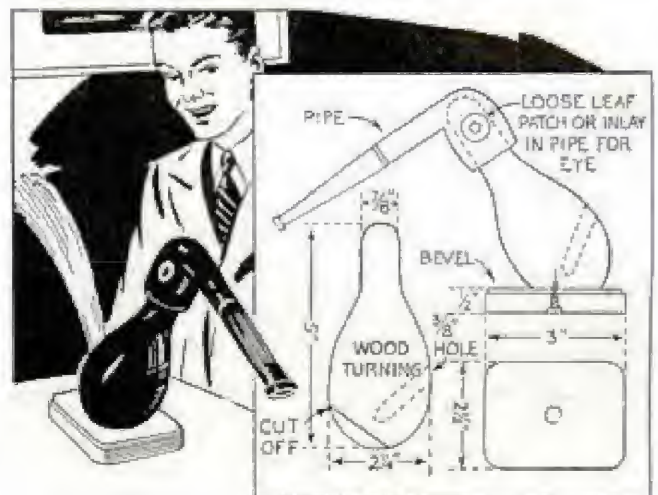
inner surface receiving the abrasive action. By holding the sandpaper in a cup form in your hand, a wood ball can be sanded in the same manner. Care must be taken to hold the sandpaper to the side and top of the ball to avoid tendency of the ball to jump off the sander.

Rubber Disk Slipped on Flag Pole Shields Pulley Against Sleet

To keep ice and sleet out of the slot and pulley of a flag pole, one school janitor provided a shield cut from a piece of inner tube. When this was fitted snugly over the top of the pole to rest just above the pulley slot, it formed a cone-shaped shield which was found highly effective.



Turned "Bird Valet" Holds Pipe and Cleaners

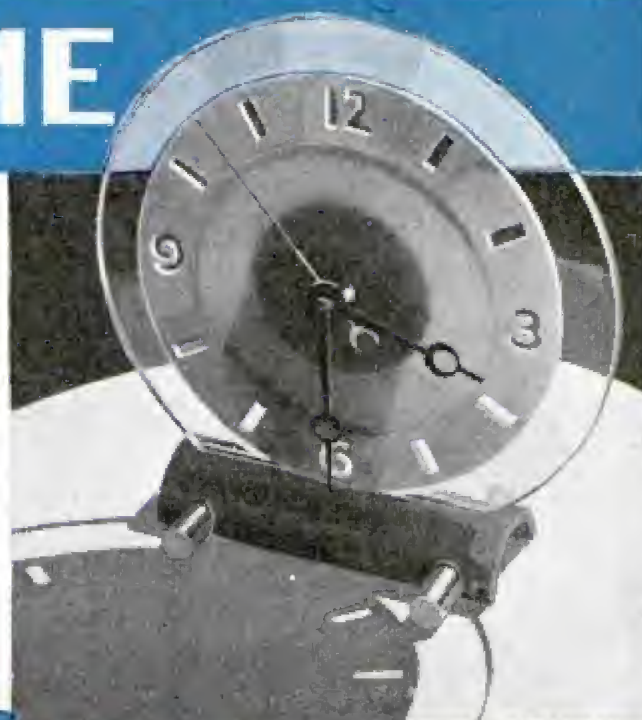


It takes both the pipe and the cleaners to complete this droll bird valet for without them he looks like nothing more than a miniature bowling pin. The pipe adds his head and bill, and the cleaners provide a tail. It takes only a few minutes to turn the body from hardwood on the lathe, drill the hole for the pipe cleaners, and mount on a base as shown. The latter can be enameled white and the body black. A linen loose-leaf patch or an inlay on each side of the pipe bowl forms the eyes.

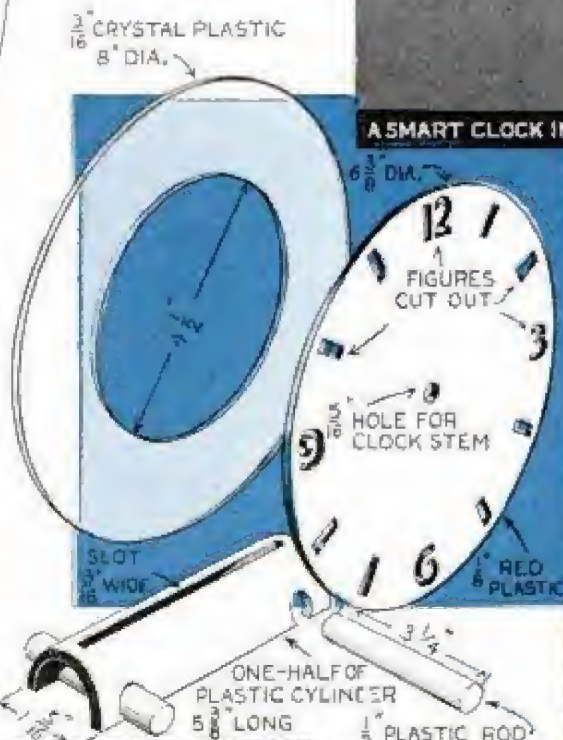
Thurston Supply Co. Kreimpel Co. Sutterberg, Calif.

Design for TIME

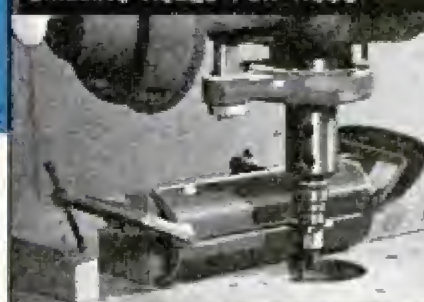
WITH its red dial backed by a crystal ring, this colorful clock case is assembled from plastics, and makes a distinctive mantel piece. After jigsawing the figures in the dial, it is trued up on a disk sander, using a pivot pin as shown in the photos below, and cemented to the ring. The base of the case is a length of red plastic tube drilled to take two plastic rods as indicated, then cut in half and slotted to take the edge of the ring. The slot must be cut carefully to get a good fit. The clock is a small electric movement, which can be obtained from any clock dealer at a nominal cost. If specified when ordered, the hands that come with the clock will be of the proper length. If you already have a movement the hands can be shortened or lengthened easily with little trouble.



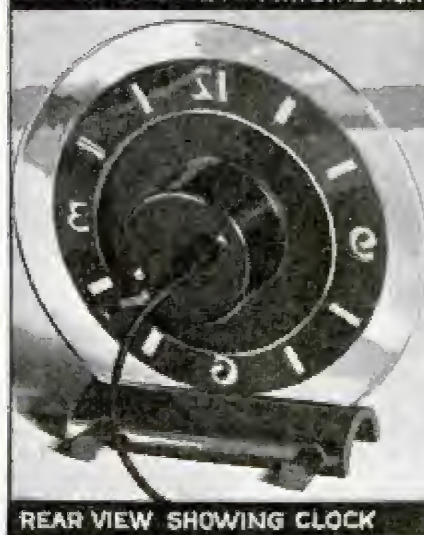
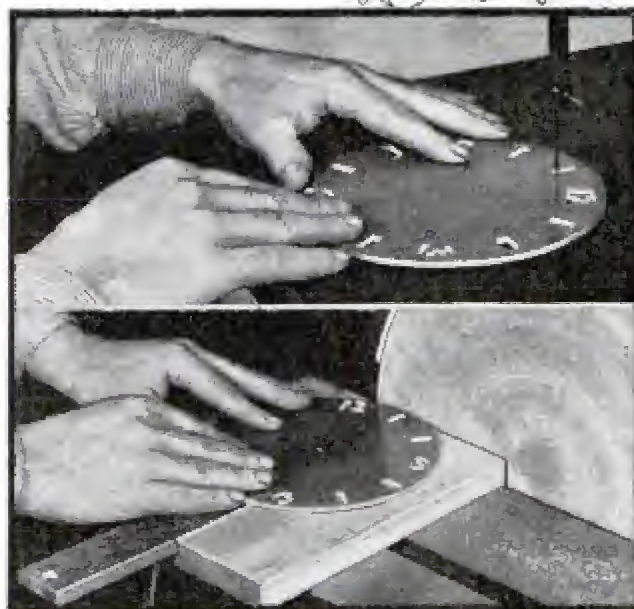
A SMART CLOCK IN COLORFUL RED & CRYSTAL PLASTIC



DRILLING HOLES FOR RODS



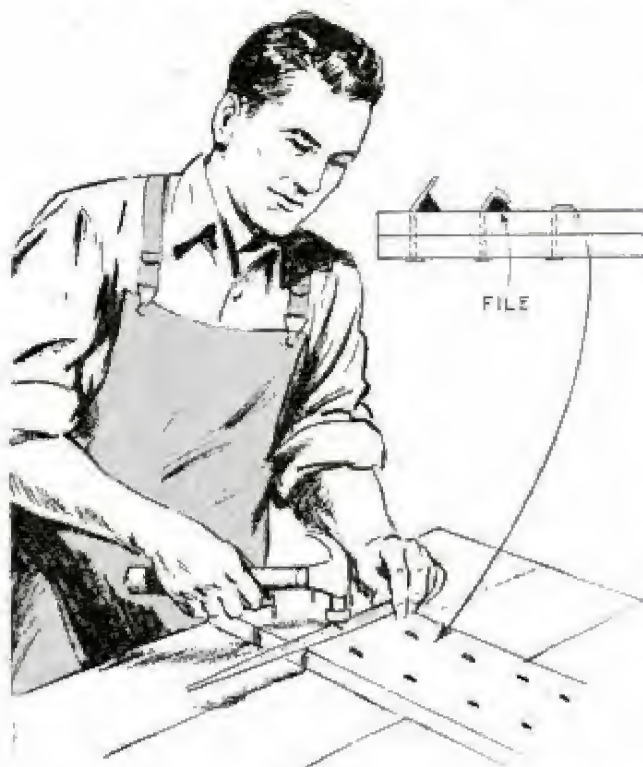
CUTTING GROOVE FOR CRYSTAL DISK



REAR VIEW SHOWING CLOCK

Caddy built. Steps 1-9

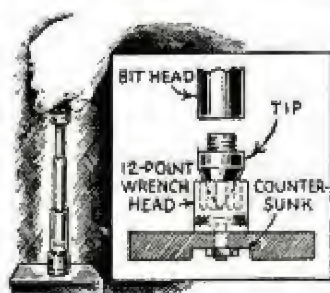
Nails Clinched over Old File Can't Tear Clothing



Nails clinched in the ordinary way on boxes, crates or doors which must be handled, frequently tear clothing or cause injury due to the projecting points. To prevent this and at the same time clinch the nail more tightly, bend the projecting point over an old three-cornered file and then drive the point into the wood.

Tip of Electric Soldering Iron Removed without Damage

Tight-fitting tips on electric soldering irons are frequently hard to remove without damage when the head is clamped in



the vise and the tip is loosened with pliers or pipe wrench. To hold the tip immovable while unscrewing it, get a 12-point socket wrench head of suitable size and mount it on a wooden base by means of a short carriage bolt. Or, simply grip it in a vise. In use, you insert the tip into the wrench opening and, pushing down firmly to prevent the tip from slipping upward, turn it by the handle. The

wrench head makes contact with all four corners of the tip. Do not use a hexagon wrench head as it will not fit properly.

—W. C. Wilhite, Carlinville, Ill.

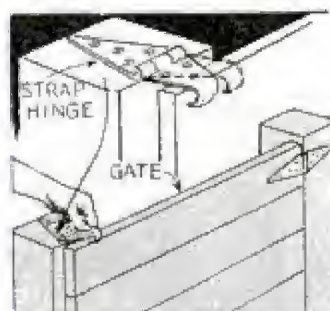
Chemical Crystals Are Crushed with Safety Razor

Amateur chemists and photographers who have occasion to crush chemical crystals will find that the frame of a discarded safety razor serves nicely for the purpose.

The curved face of the razor permits it to be pressed down on the crystals with a rocking motion, thus doing a quick and effective crushing job.



Self-Latching Gate Fastener from Strap Hinge

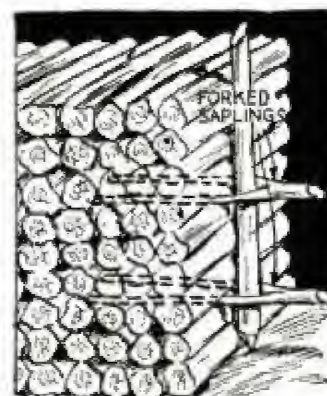


With one end bent over to form a hook, a strap hinge provides a good latch for a small wooden gate. When the latter is closed the latch automatically holds it. It's best

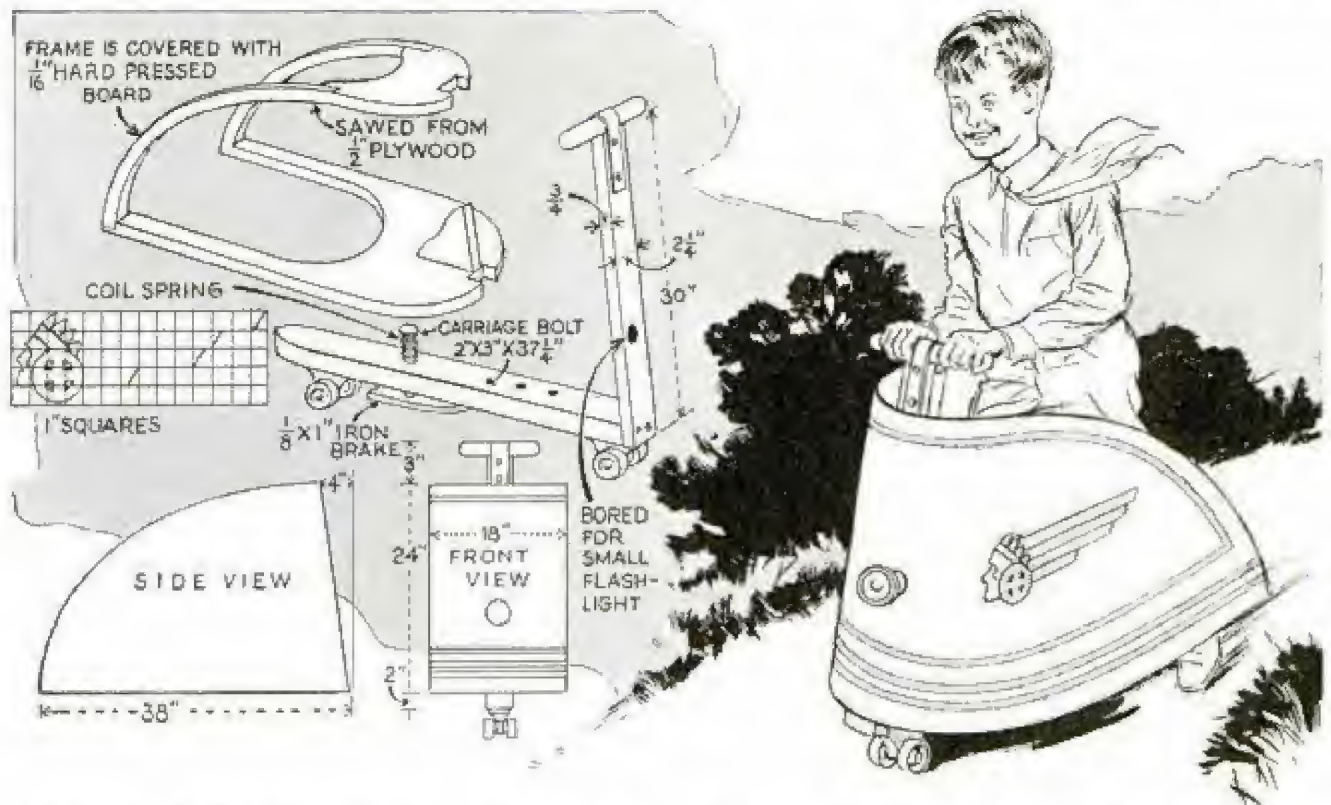
to saw off the gate post flush with the top of the gate to support the hinge, or a block can be nailed to the side of the post.

Firm Anchor on Woodpile

There's no need to drive stakes in frozen ground to support piles of cordwood. Forked saplings are stuck between layers of wood and stout sticks are slipped through the ends as shown in the drawing. The weight of the wood on the saplings will keep the anchor thus formed in position.



Streamlining Adds Snap to Sidewalk Scooter

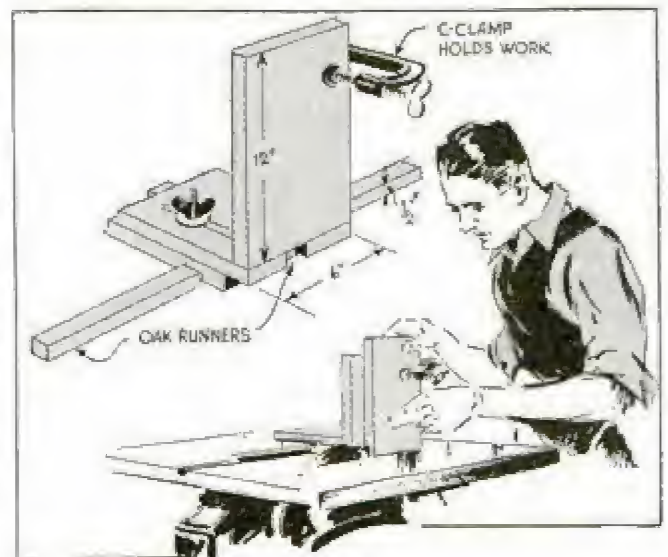


Patterned after modern streamline locomotives, this sidewalk scooter is sturdy, yet comparatively light in weight and the construction is possible with hand tools. The chassis is made from any available stock, and skate wheels are attached in the usual manner. An effective brake consists of an 18 to 22-in. length of lightweight flat iron, bent as shown and bolted to the underside of the chassis. A hole drilled through the chassis directly over the free end of the brake shoe is fitted with a bush-

ing in which the carriage bolt will slide easily. A coil spring is also provided to raise the bolt when foot pressure is released. The frame for the shield consists of two horizontal U-pieces notched to fit the steering post to which they are attached. Then a piece of $\frac{1}{16}$ -in. hard-pressed board is cut and attached to the frame. A small flashlight can be set in a hole bored in the steering post and the shield is then given a snappy paint job in orange, with a red-and-white emblem.

This Simple Jig for Cutting Tenons Fits Any Circular Saw

Here's a jig for safely cutting tenons on your circular saw. It consists of three blocks; one is the base and the other two are fastened together at right angles as indicated. The underside of the base is slotted for an oak runner, which slides in the miter-gauge groove of the saw table. The upper surface of the base and the lower surface of the horizontal block that fits on the base, are each grooved at right angles to the first groove, to fit a runner which permits lateral adjustment. The horizontal block is fastened to the base with bolts which slide in slots to permit adjusting the jig for cutting tenons of different thicknesses. A C-clamp will hold the work.

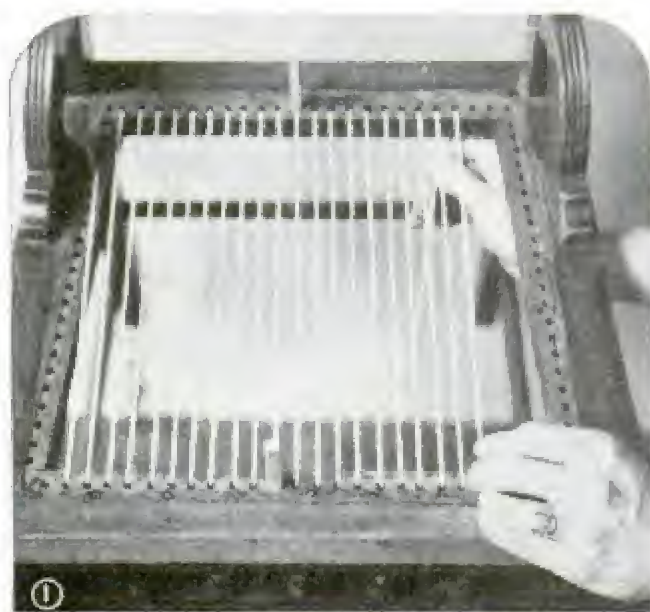


RE-CANING

Easily mastered by any beginner. All you buy is the cane as no tools except wood pegs are needed

WHY not get out that old rocker from the attic if all it needs is a new seat? Once you have acquired the knack of weaving cane, there's no trouble at all in doing this work and it's a possibility for making some spare-time profits.

Size of Cane: First you take a piece of cane from the broken seat and go to your furniture dealer so that new cane of the same size can be obtained. If the worn-out seat has been removed, you determine the correct size of cane to get by the size of the holes in the seat frame and the distance they are spaced apart. If the holes are $\frac{3}{16}$ in. in diameter and $\frac{3}{8}$ in. apart, use a size termed as superfine. When they measure $\frac{1}{2}$ in. apart, use fine fine; when $\frac{5}{8}$ in. apart, use fine. Quarter-inch holes $\frac{3}{4}$ in. apart require medium and $\frac{7}{8}$ -in. holes, $\frac{7}{8}$ in. apart take common. The two sizes generally used are fine and medium. Cane comes in bundles of 1,000 ft. or half bundles of



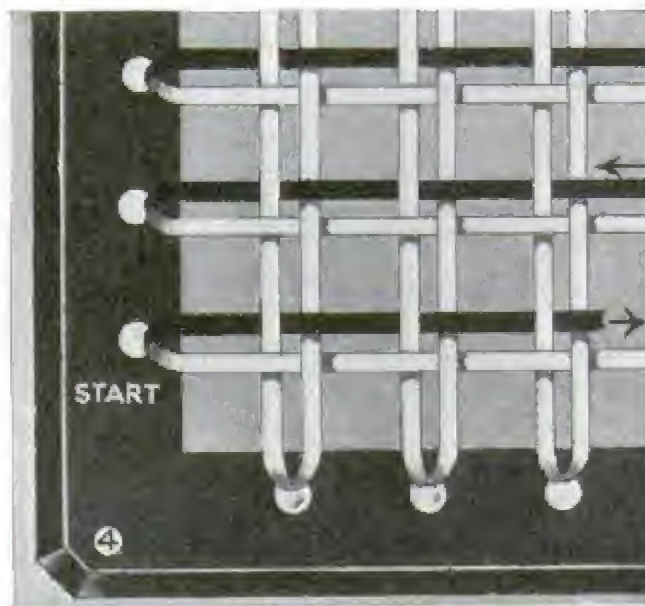
① BEGIN STRINGING FROM THE FRONT CENTER HOLE



② CROSS STRANDS ARE STRETCHED FROM LEFT TO RIGHT



③ ANOTHER LAYER OF STRANDS GOES OVER THE FIRST ONE



④ THE WEAVING BEGINS — UNDER ONE STRAND AND OVER THE NEXT

Cane Chair Supply Co. *Anoka, Minn.* *J. L. Hammett Co. Kendall* *Square Cambridge Mass* **saves that old chair**

500 ft. A full bundle will reseat three or four chairs of average size. If you wish to purchase just enough material for a single seat, keep in mind that sixteen single strands will do a seat measuring about 14 in. square.

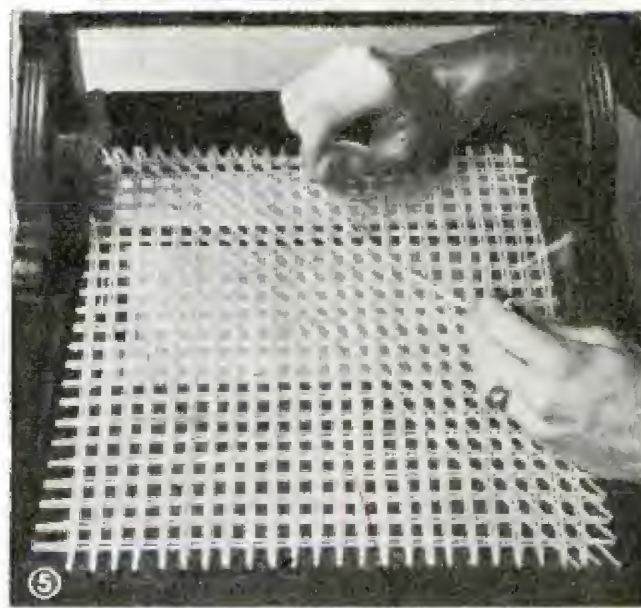
Cane Is Kept Moist: Remove the old cane seat and clean out the holes in the frame. For tools you need only five or six tapered wood pegs. If the holes are not too large, golf tees will serve for pegs. Each time you are ready to use a new strand of cane, it should be immersed in water for a few moments. This makes it somewhat pliable and easier to work. However, too much soaking makes the cane too limp for easy working. Your hand dipped in water occasionally while handling will keep it sufficiently moist.

Square Seats Easiest: A square or rectangular seat is easier to weave than a round one. When weaving a round seat, you must skip several holes so that the strands will run parallel. The first step in weaving a square seat is to run the strands vertically from front to back. Start with the center hole in the front rail as in Fig. 1. Insert the strand, letting the end extend about 3 in. below, and hold in place with a peg. Run the entire strand between the thumb and forefinger to keep it from twisting so that the glazed surface will be on top. From the center front hole pass the strand through the center back hole, drawing it firmly but not too taut to break, and fasten with a peg. Bring the end up through the adjacent hole on one side, shift the peg to this hole, and, running the cane through your fingers as before, draw it back to the front rail, parallel to the previous strand, then insert into the hole and fasten with a peg. This procedure is continued until all vertical strands are in place, omitting the corner holes.

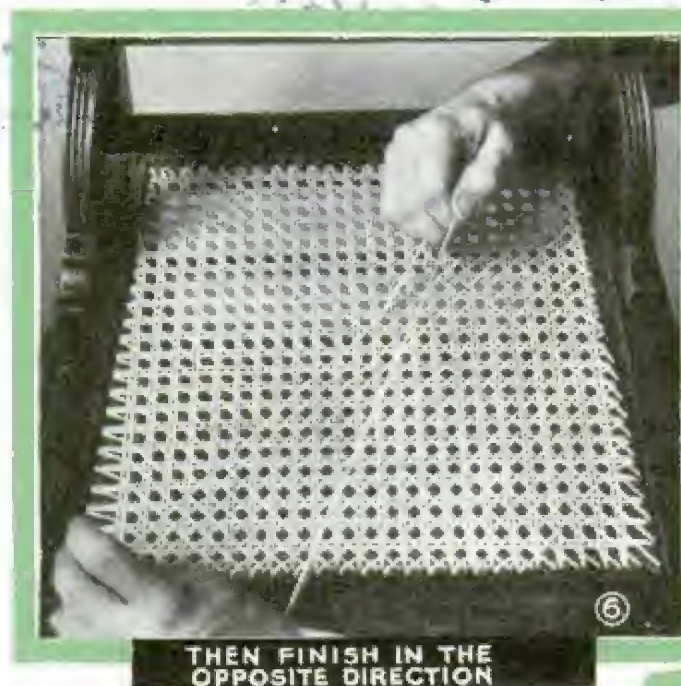
The second step is merely a repetition of the first step except that the strands run across the first ones as in Fig. 2. When a strand is nearly used up and is too short to reach across again, peg the end and start



HERE'S A FINISHED JOB -- BOTH SEAT AND BACK ARE RECANED. VARNISHING WILL MAKE THIS CHAIR AS GOOD AS NEW



START THE DIAGONAL STRANDS IN ONE DIRECTION



THEN FINISH IN THE
OPPOSITE DIRECTION

with a new strand. You do not join strands. When all horizontal strands are laced over the vertical ones, you are ready for the next step.

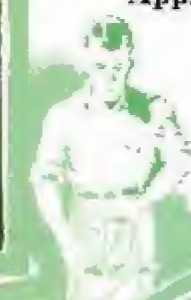
Fastening Loose Ends: Before starting the third step, you can fasten the free ends of the strands thus far in place by tying to the underside. To do this, wet the end of each strand thoroughly, pass it under one of the loops of cane between the holes and bring it around in a knot. If necessary, a knife blade will aid in slipping the strand under the loop. The third step is a repetition of step one, a second layer of vertical strands being laced over the horizontals as in Fig. 3.

Actual Weaving Begins: With the next step, Fig. 4, you begin actual weaving. Weaving from left to right, each horizontal strand, indicated in black, is passed under one vertical and over the next adjacent one. Each time you say to yourself "under and over," for each pair of verticals, until you reach clear across. After passing the strand down through the hole and up the next, you are ready to make a return trip from right to left, but this time weaving over and under instead of under and over. In weaving, frequently draw the entire strand up taut.

The Pattern Takes Shape: Next is the fifth step—the diagonals, Fig. 5. Starting at the left front corner hole, work a strand under the double row of horizontals and over the double row of verticals, continuing in a like manner also on the return trip.

By studying a sample taken from the old seat you will be able to correct yourself if you have difficulty. In step six, Fig. 6, you make a diagonal weave in the opposite direction. You use a reverse procedure for this, passing over the horizontals and under the verticals. When this weave is completed, all loose ends are tied to the underside.

Applying the Binding: The binding, Fig. 7, covers the holes around the border of the seat and provides a neat, finished edge. Use a wide strand known as binder.



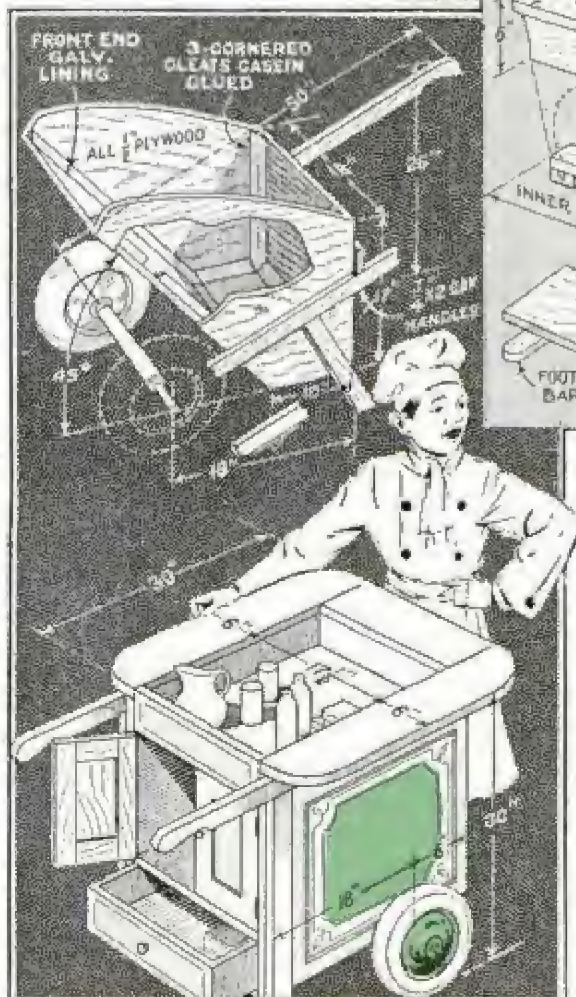
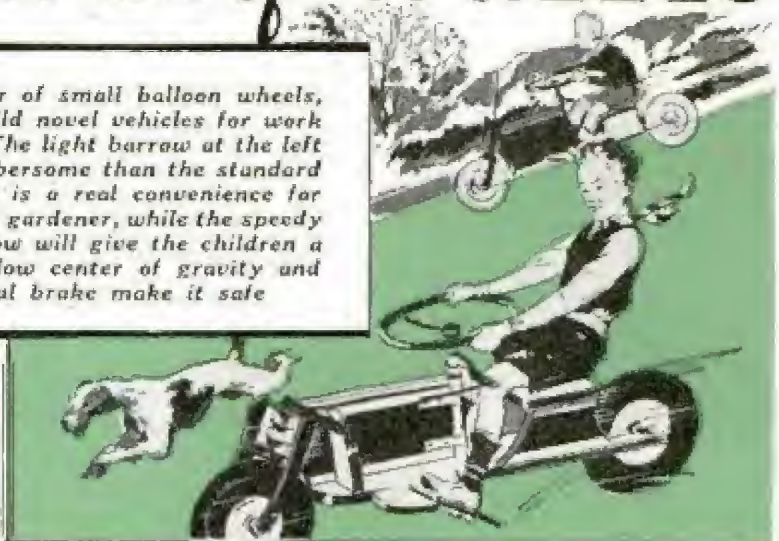
A BINDING AT THE EDGES
COMPLETES THE JOB

To fasten this over the holes, you use a strand of the same size cane as you have been using for weaving. Skipping every other hole, pass the end up through the hole from the bottom, lay the binder over the row of holes and form a loop around the binder with the cane as you again pass the strand down through the same hole. This method is continued around the entire border of the seat. If you find it difficult to pass the strand through some of the holes, you can enlarge the opening by working a nail around in the hole. If the seat, after it has dried thoroughly, rings when struck sharply by the hand, you have done a good job. A coat of clear varnish or lacquer on the cane will make it impervious to moisture and ready for a long period of usage.

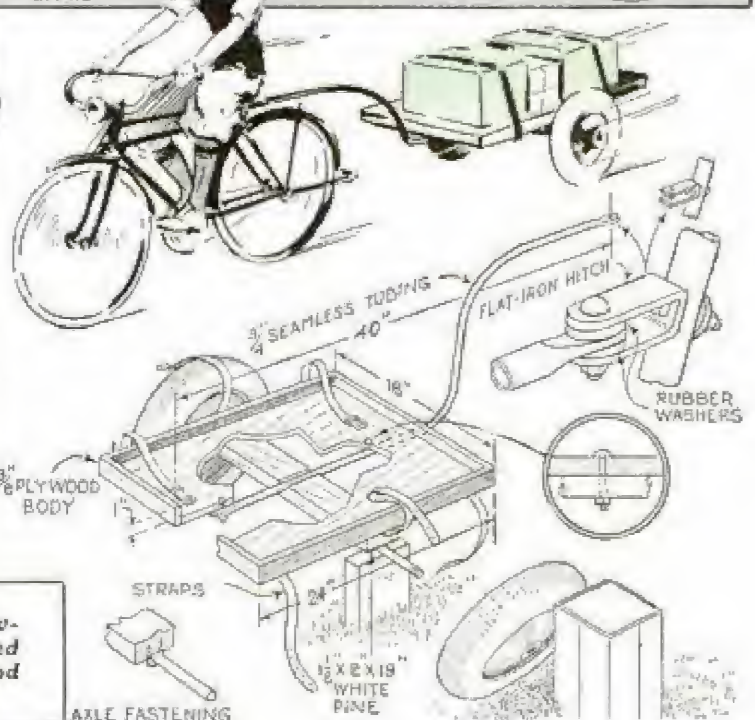
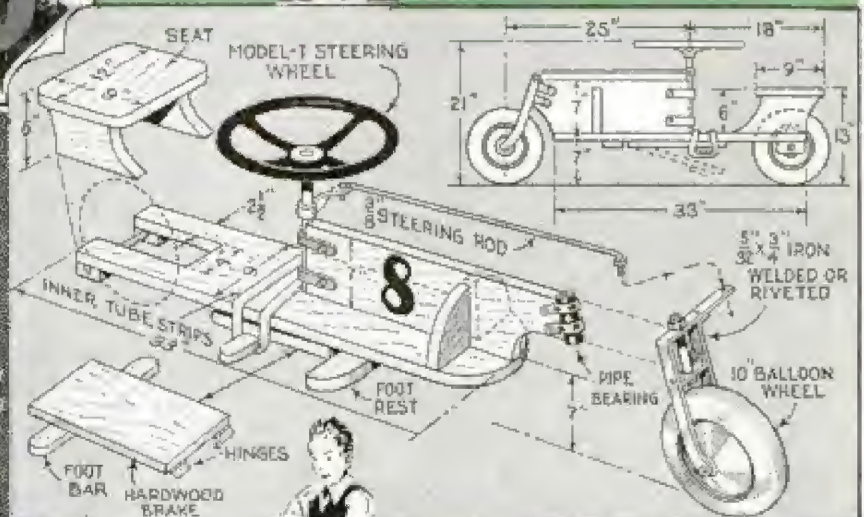
What You Can Do with a COUPLE of WHEELS



With a pair of small balloon wheels, one can build novel vehicles for work and play. The light barrow at the left is less cumbersome than the standard models and is a real convenience for the amateur gardener, while the speedy coaster below will give the children a thrill. Its low center of gravity and powerful brake make it safe.



A cart to convey food, hot or cold, and beverages from kitchen to garden is illustrated above. The cycling vacationist will get good use from the simple trailer at the right.



Viewing Motion-Picture Films on Pen-Type Flashlight

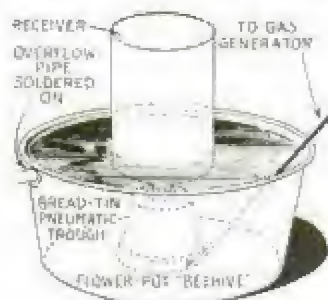


This pocket film viewer is handy and useful when editing your motion-picture films. It consists of wire bent to grip a pen-type flashlight and a small magnifying glass fastened to the frame with adhesive tape. A piece of transparent paper is glued in place as illustrated to diffuse the light from the flashlight. The film is placed directly over the paper. Such a viewer is especially helpful when splicing in titles, as they may be read directly from either the small 8-mm. or the 16-mm. size film.

Pneumatic Trough and 'Beehive' for Chemical Experiments

Home chemists who desire to experiment with the collection of gases will find that an ordinary bread tin having an overflow pipe soldered onto one side near the top, will serve very well as a pneumatic trough, while a small flower pot, altered as shown in the sketch, makes a good "beehive." A

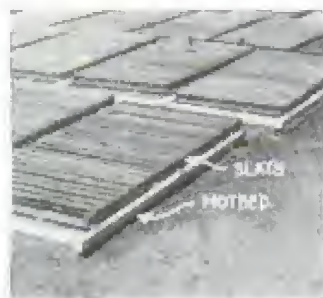
large bottle in which the gas is collected is set in an inverted position over the hole in the bottom of the flower pot, the latter, of course, being submerged below the surface of the water. The rim of the flower pot is notched with a file to take the tube



from the gas generator. In use, the bottle and pan are filled with water. Then the bottle is turned upside down and placed over the flower-pot hole. As the gas comes in, water will run out and be replaced with gas until the bottle is filled.

Slats Across Top of Hotbed Give Partial Shade

These slats over hotbeds permit ample sunlight to reach the seedlings on bright days, yet allow individual plants to benefit from intervals of shade during the heat of midday, as at this time each slat casts a "traveling" shadow. The slats are sawed quickly and a single small nail through each holds them in place. This method is excellent for tender plants which are apt to suffer from continuous hot sunshine.

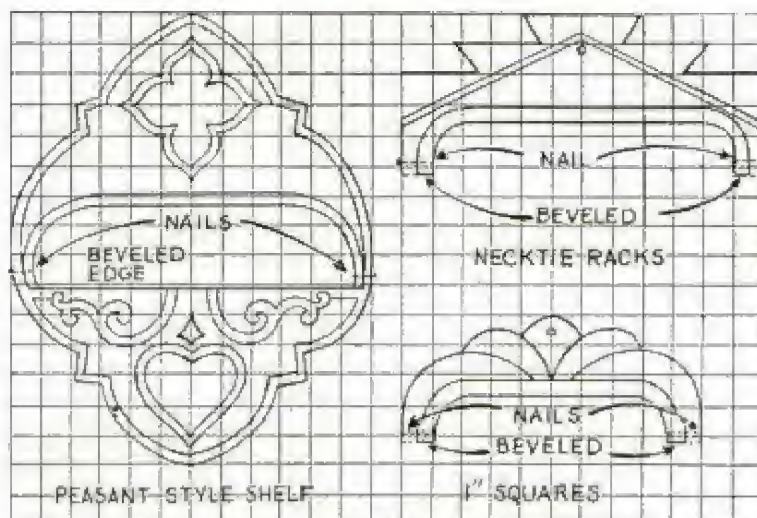


Wire Wound on Threaded Work Protects It in Chuck

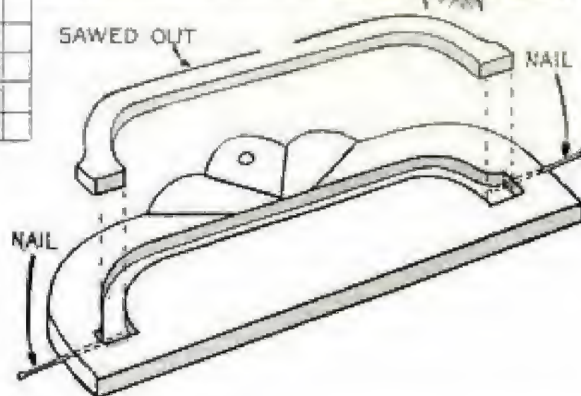
When it is necessary to chuck threaded work in a lathe, you can protect the threads by winding copper wire in them. It should be of a size large enough to project beyond the height of the threads. You'll find the wire better than a split brass or copper tube.—C. W. Woodson, East Aurora, N. Y.



One-Piece Tie Racks and Shelves Fold Flat



Scrollsawed from single pieces of plywood or other suitable stock, these necktie racks and small wall shelves pivot to the backs, and when folded, fit in the space from which they were cut. Brads or finishing nails form pivots. After cutting out the parts, the front lower edge of the pivoted member of such a shelf or rack must be beveled slightly in order to provide sufficient clearance to prevent binding. While a few suggestions are given here, anyone can elaborate on the ideas and produce an endless variation of designs.



This Quick-Acting Clamp Holds Work While Scrollsawing

Here's a clamp that disposes of the problem of holding work for intricate cutting with a hand scrollsaw or coping saw. It

consists of a base, a sliding arm and a cam, all made from scrap hardwood stock. Exact sizes are of no importance. You can make it up to suit your work. The arm is faced with a square piece of rubber cut from a stair tread to prevent marring the stock, and the small end slides between a couple of angle-iron brackets to permit adjustment. Also, the cam is pivoted between the brackets. A coil spring fitting tightly in a hole drilled partly through the arm from the underside raises the latter when the cam is released.



Hip-Boot Tops Held by Clothespin to Avoid Cracking Uppers

When you set hip boots in a closet, clip the tops together with a spring-type clothespin as indicated. This keeps them from folding over, which will cause the rubber to crack if the boots are left in this position for any length of time.



"SKIPPER"—Low-Cost

PART I

IDEAL for river or lake use, yet big enough to ride rough water, "Skipper" is a smart little craft combining graceful lines with low-cost, simplified construction. Cost of materials will vary between \$30 and \$40. You can get an idea of "Skipper's" performance from Fig. 1 and photos below it, also Fig. 5. Figs. 2, 3, and 4 show construction.

Begin work by making up a full-size pattern of each frame, as shown in Fig. 6. Draw one side only, then fold the paper on the centerline and with carbon paper, facing up, duplicate the outline on the opposite side of the centerline.



①



PLENTY OF ROOM



SUITABLE FOR SMALL MOTORS



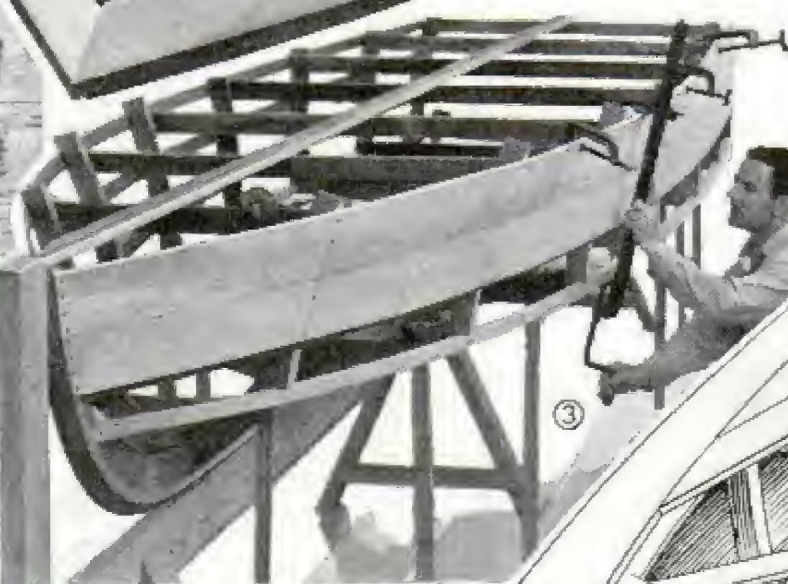
HAS A V-BOTTOM



SPEED WITH SAFETY

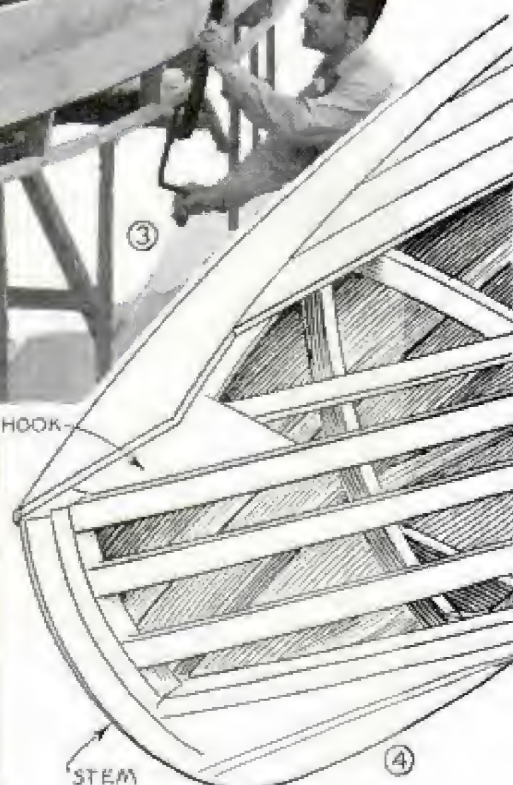


②



③

BREAST HOOK



④

"SKIPPER"

LENGTH — 14 FT.
BEAM — 54 IN.
FREEBOARD — 15½ IN.
DEPTH — 24 IN.
DRAFT — 5 IN. @ 725 #
WEIGHT — 275 LB.
PASSENGERS — 5
MOTORS — SUITABLE FOR
MOTORS FROM 4 TO 24 HP.
SPEED — 9 TO 25 M.P.H.
DEPENDING ON MOTOR

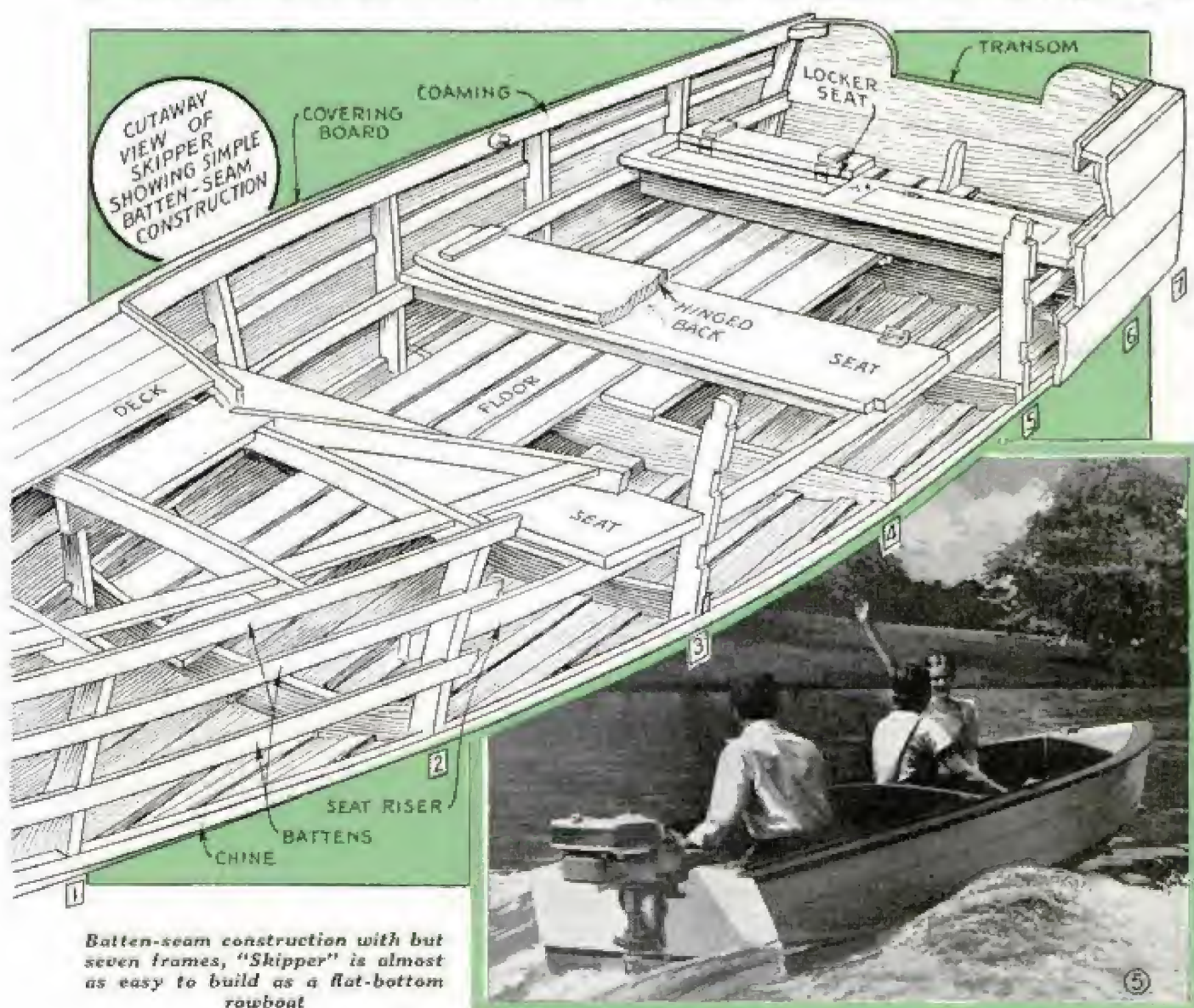
Outboard Runabout

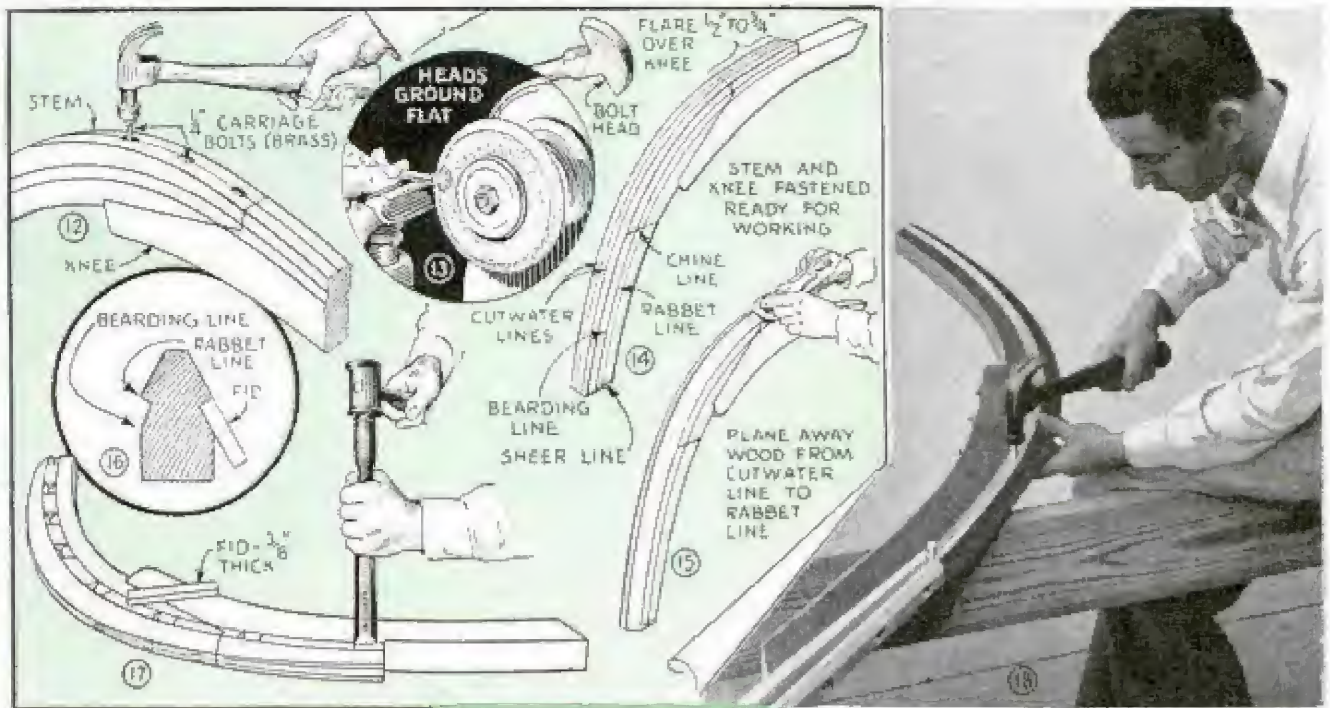
Fig. 6 shows the general frame shape, while Fig. 7 gives the dimensions for each frame at the points indicated.

After making the paper patterns, transfer the outlines to the $\frac{3}{4}$ -in. frame stock and saw out on the bandsaw. Each frame has two side members, and these should be nailed together and sawed in one operation. The chine notches can be cut at the same time, with the exception of frame No. 1, which is beveled and best fitted after the frames are set up. The chine stock is 1 by 1 in., and a short section of the stock should be used to locate the position of the notch on the paper patterns and later on the frame stock. Fig. 8 shows how the chine fits into the corner of each frame—

one edge even with the edge of the side frame. At frame No. 1, the location is as shown in the inset, Fig. 8.

The parts of each frame are assembled over the paper pattern, as shown in Fig. 10. The pieces are first nailed together, then fastened with screws. The joint is a simple butt joint except at frame No. 7, which is half-lapped, as shown in Fig. 9. Note also in this drawing that the bottom piece of frame No. 9 is beveled at 12 degrees. This bevel applies to the top and bottom edges, also the top of the keel notch and the top of the chine notch. All other frames are cut square across. Be sure to mark the centerline on each frame across the temporary crossbar before removing it from





notches to make one continuous rabbet, as shown in Fig. 19.

The keel is cut from 1½-in. yellow pine or white oak, 4½ in. wide. Square up the end which butts against the stem, and then lay off the station marks, as shown in

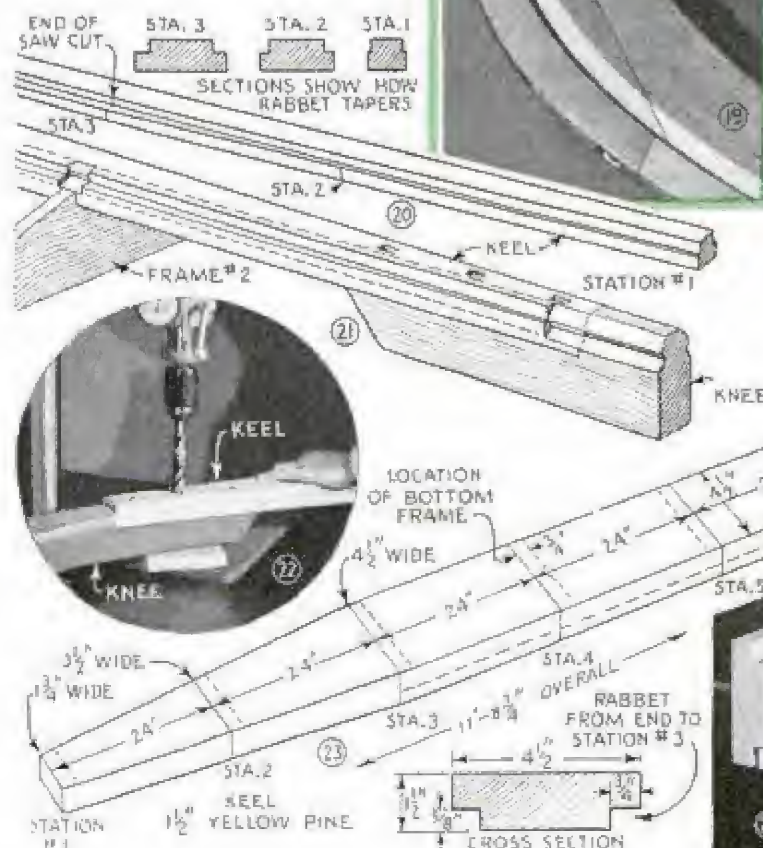
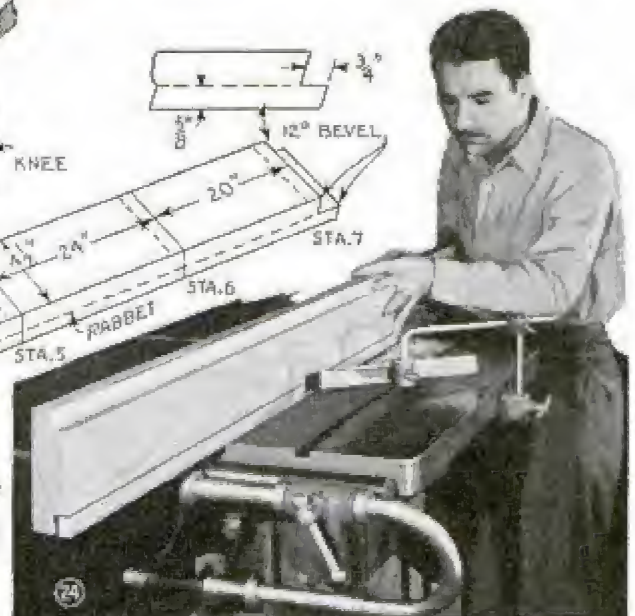


Fig. 23. Cut the keel to exact length, and make the step at the stern end as shown in the drawing. Now, on the circular saw, Fig. 24, cut a rabbet along each edge of the bottom of the keel, starting at the stern and stopping at station No. 3. Shape the forward part of the keel to the dimensions given in Fig. 23. Now pick up the saw-cut rabbet, Fig. 20, at station No. 3, and continue it at the same depth but tapering in width until it becomes zero at the end of the keel. This taper cut is not the true rabbet. Before the

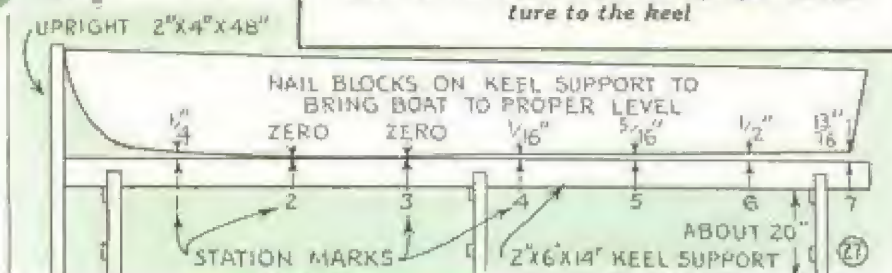




latter can be cut, the keel must be fastened to the stem, using three carriage bolts. The heads are left round, and are counter-sunk a little over $\frac{1}{4}$ in., as shown in Fig. 22. Projection of the keel beyond the stem should be faired off with a plane, carrying the curve about 12 to 15 in. along the keel. You can now spot in the rabbet at the end of the keel, as shown in Fig. 21, making the cut the same as at the end of the stem. Then, setting frame No. 2 in place and using the fid,



"Skipper" is built on a keel support of 2 by 6 in. yellow pine. Small blocks of wood fastened to the support give the proper curvature to the keel



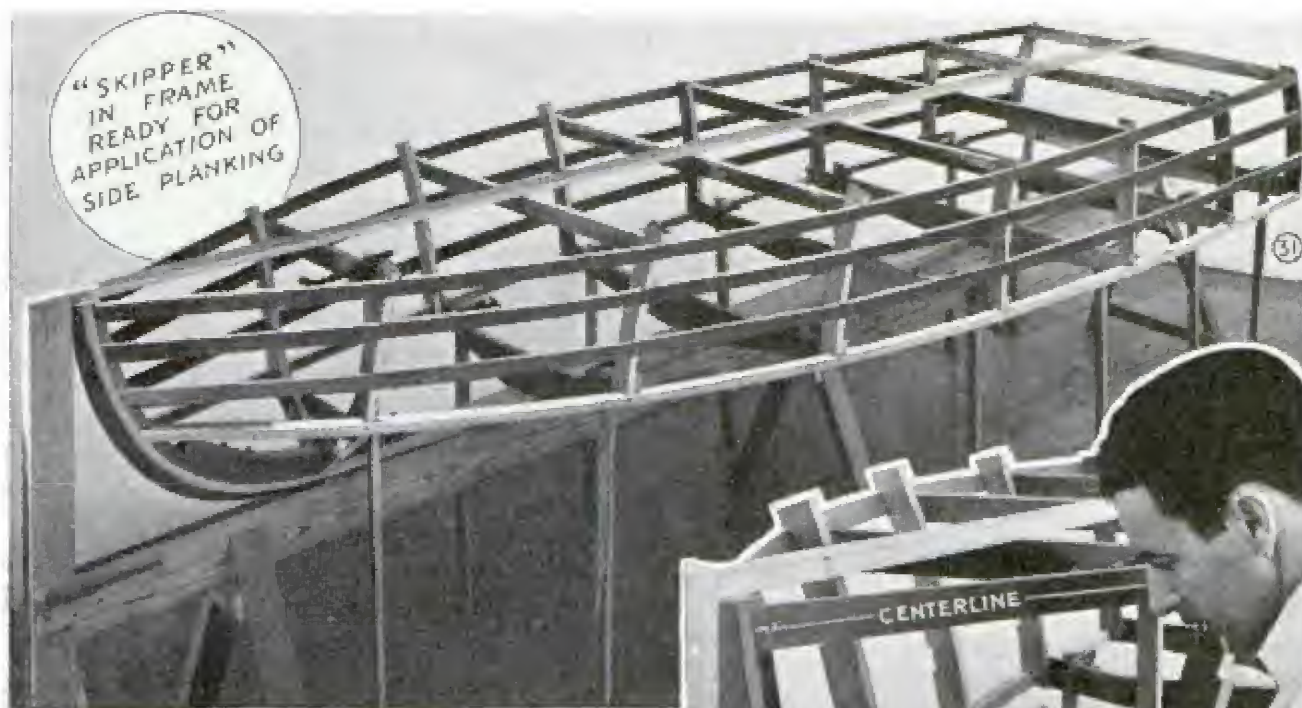
you can spot in the rabbet at station No. 2. Draw a fair line between these two cuts and cut the rabbet. Fig. 18 shows the final step of driving $\frac{3}{8}$ -in. softwood dowels into the rabbet where the joints cross it. These stopwaters go right through from side to side, and are trimmed off flush.



1"x2" STRONG BACK

$\frac{1}{2}$ x $\frac{1}{2}$ " NAILING STRIP





The building trestle, Figs. 26 and 27, is a 2x6-in. plank, 14 ft. long, supported on trestle legs as shown. The top edge of the plank must be straight, and it must be set with a spirit level. This is important. Place the keel and stem assembly on the keel support, and, under each of the station marks on the keel, locate and tack small blocks of wood of the thickness shown in Fig. 27. Fasten the keel to the keel support with three lag screws, Fig. 26. These will be



removed later and the holes plugged. The 2 by 4-in. end support should be plumbed vertical, the stem being toe-nailed to the top.

Now the frames are set in place at the points previously marked on the keel. Each frame is fastened at right angles to the keel centerline with 2 in. No. 10 screws, one on each side from the underside of the rabbet, Fig. 25. Countersink the screw heads $\frac{1}{8}$ in. One other point of importance can be seen in Fig. 30—frames Nos. 1, 2, 3, and 4 are placed so that the side frames face the front. Sides of frames 5 and 6 face aft. The last frame, No. 7, is raked as in Fig. 28.

Fig. 30 shows all the frames set up. The strongback is nailed in place first, each frame being leveled vertically before nailing. Support sticks hold each frame level crosswise, while the nailing strips keep the frames spaced equally.





The edges of the side frames now must be beveled to carry out the contour of the boat. The proper bevel can be determined easily by springing a light strip of wood across the frames. After beveling, cut the batten notches, taking the spacing from the dimensions given in Fig. 7. Check the marks by nailing a batten in place. Batten notches are easily cut by clamping guide strips to the saw, as in Fig. 29. Clean out the waste with a wood chisel and then smooth up with a rasp.

Fig. 31 shows "Skip-



PLANKS ARE FITTED FROM BATTEN CENTERLINE TO BATTEN CENTERLINE, THE SHAPE BEING DETERMINED BY SPILING

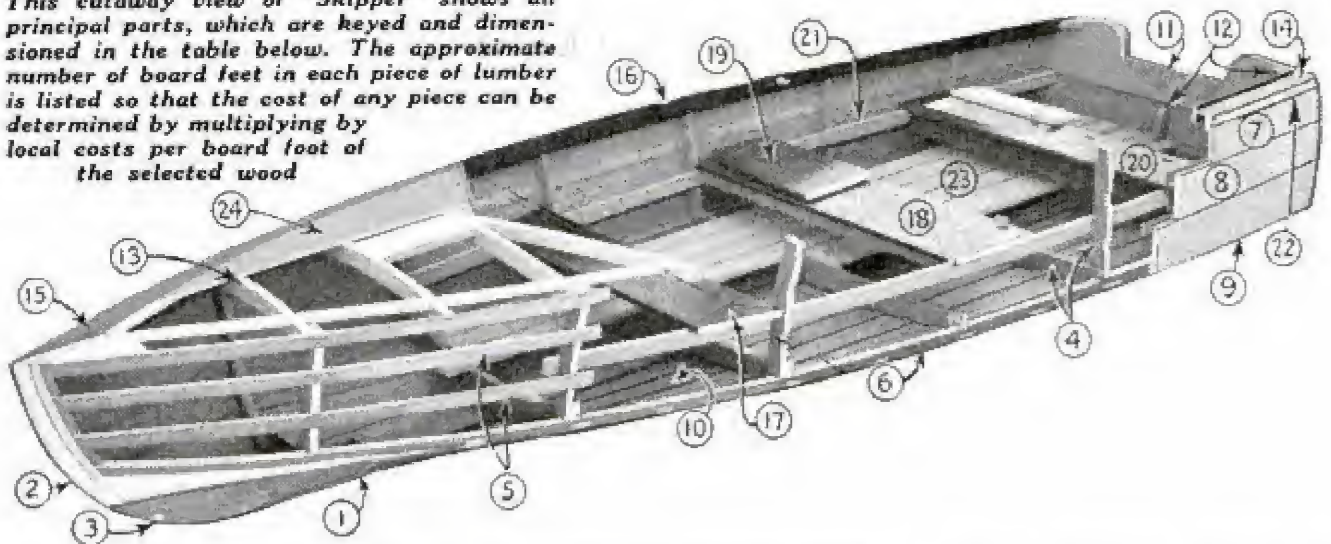


to lie immediately behind the bearding line. The chine is similarly beveled and is also notched to fit around the stem, as in Fig. 32, being fastened with one screw from the side and one nail from the top, as in Fig. 33. At the frames, the chine is fastened with one 2-in. No. 10 screw countersunk to allow later shaping of the chine pieces. Before fastening the chine, check each frame with a level, as in Fig. 34. All battens and the chines are sawed off flush with

the rear face of frame No. 7. The first planks to go on are the center ones on each side, Fig. 35. To determine the shape of these and other planks, you will need a 3/4-in. "spiling" board sawed out roughly so as to fit between the batten centerlines. Do not force the spiling board—let it make its own curve and tack it lightly in place. Fig. 36 shows the operation of spiling, using a small block of wood with one corner cut off as an index. The block is placed so that one edge touches the batten centerline



This cutaway view of "Skipper" shows all principal parts, which are keyed and dimensioned in the table below. The approximate number of board feet in each piece of lumber is listed so that the cost of any piece can be determined by multiplying by local costs per board foot of the selected wood.



Key No.	LUMBER Part and Size Sizes in inches except where marked in feet	Board Ft.
1	Keel—1 piece 1½ net x 4½ net x 12 ft. yellow pine...	12
2	Stem—1 piece 1¾ net x 6 x 5 ft. white oak...	5
3	Knee—included in Item 2	00
4	Frames—2 pieces 1 x 8 x 10 ft. poplar	14
5	Battens—5/16 net x 1½ net—3 pieces 16 ft., 6 pieces 14 ft., 2 pieces 12 ft., 2 pieces 10 ft.	14
6	Chine—2 pieces 1 net x 1 net x 16 ft. yellow pine...	5
7	Sheer Plank—2 pieces ¾ net x 10 x 16 ft. white pine...	28*
8	Center Plank—2 pieces ¾ net x 8 x 16 ft. white pine...	22*
9	Shutter Plank—2 pieces ¾ net x 8 x 14 ft. white pine...	20*
10	Bottom Planking— Garboard—2 pieces ¾ net x 8 x 14 ft. white pine...	20*
	Bottom 2—2 pieces ¾ net x 8 x 14 ft. white pine...	20*
	Bottom 3—2 pieces ¾ net x 8 x 12 ft. white pine...	16*
	Bottom 4 and 5—2 pieces ¾ net x 10 x 10 ft. white pine	18*
11	Transom—1 piece 1 x 12 x 4 ft. white pine...	4
	1 piece 1 x 8 x 4 ft. white pine...	3
	1 piece 1 x 10 x 4 ft. white pine...	3
12	Transom Knees—1 piece 1½ net x 10 x 2 ft. white oak...	2
13	Deck Beams—1 piece 1 x 8 x 4 ft. white pine...	3
14	Covering Board—cut from sheer plank scrap...	00
15	Covering Board—1 piece 1 x 8 x 16 ft. white pine...	11
16	Coaming—2 pieces ¾ net x 3 x 12 ft. white pine...	6*
17	Front Seat—1 piece 1 x 10 x 4 ft. white pine...	4
18	Center Seat—1 piece 1 x 14 x 4 ft. white pine...	5
19	Seat Back—1 piece 1 x 12 x 4 ft. white pine...	4
20	Rear Seat—1 piece 1 x 6 x 4 ft. white pine...	2
21	Seat Riser—2 pieces ¾ net x 1¾ net x 10 ft. yellow pine	3
22	Sheer Molding—2 pieces 1 in. half round, 16 ft.	4
23	Floor—6 pieces ¾ net x 4 x 10 ft. No. 1 white pine...	20
	2 pieces ¾ net x 4 x 8 ft. No. 1 white pine...	6
	1 piece ¾ net x 6 x 10 ft. No. 1 white pine	5
24	Deck—scrap plank stock	
	Keel Form—1 piece 2 x 6 x 14 ft. No. 1 yellow pine...	14
	Frame Cross Bars—30 ft. lin. 1 x 2 shingle lath...	5
	Strongback—1 piece 1 x 2 x 16 ft. white pine...	3
	Nailing Strips—2 pieces ½ net x ½ net x 16 ft.	3
	Supports—scrap	00
	Coaming Plate—included in frame lumber	00

† Actual finished sizes are marked "net." All others standard mill sizes.

‡ Resaw ¾ in. thick for covering board; ¾ in. thick for spiling board.

* Board footage of 1-in. stock, required for dressing ¾ in. net.

FASTENINGS

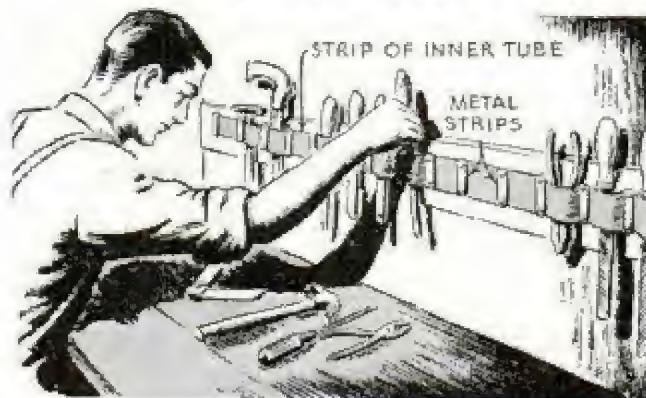
Planking—1½ in. No. 6 or 8 F. H. screws	6 gross
Planking—¾ in. No. 6 F. H. screws	3 gross
Planking—1 in. No. 15 copper nails	2 lb.
Chines and Frames—2 in. No. 10 screws	3 doz.
Frames—1½ in. No. 8 screws	4 doz.
Battens—1½ in. No. 6 screws	1 gross
Covering Board and Coaming—1 in. No. 6 screws	1 gross
Deck Beams—1½ in. No. 8 screws	3 doz.
Keel Form—¾ x 2½ in. lag screws	3
Keel and Stem—5/16 in. carriage bolts	5, 4½ in., 3, 3½ in.
§ 1 gross allowed for miscellaneous fastenings.	

Miscellaneous small items include brads, string, ½ gal. seam composition, candle wicking, tacks, hinges, 30 in. of ¼-in. brass half oval for stem band, 2 doorstops for center seat back, one 6-in. cleat, and paint totaling 1½ gal. of colors selected.

and a pencil mark is drawn around the part of the block that rests on the spiling board. This is repeated at intervals of about 10 in. When the spiling board is removed and tacked to a length of the planking stock, the block is used to relocate the exact shape of the plank. Tack two planks together and saw as one, or, you can use 1½-in. (net) lumber, cutting the plank in the solid and re-sawing to make two ¾-in. thick planks. Each plank is fastened with four 1¼-in. No. 6 screws at each frame and at the stem. Fastenings along the battens consist of ⅝-in. No. 6 screws, inserted in pairs at about 4-in. intervals, as shown in Fig. 38. Plank No. 2—the sheer plank—is fitted and fastened in the same way. In spiling this plank, the spiling board will lift above the batten and it will be necessary to use a larger marking block. After these two side planks have been fitted, Fig. 37, the boat can be turned over in readiness for application of the bottom planking.

(To be continued)

Hand-Tool Rack over Bench Has Flexible Pockets



When a number of hand tools are used at the bench, time will be saved and each tool can be kept out of the way without looking for the pocket made for it, if you use this flexible tool holder. It consists of a long strip of rubber about 3 in. wide, which can be cut from an old inner tube and fastened to a 6-in. board, on the wall back of the bench, with strips of metal or wood spaced about 4 in. apart. These are tacked or screwed in place.

—L. Schmitt, Chicago.

Attractive Signs and Name Plates Produced by Photorelief

Have you seen the new photographic prints on which the characters appear to have been carved in low relief? Here's a method which produces similar results for cards, name plates, etc. Once you have the



desired text—letters or pictures—photograph it and develop the film in strong developer for contrast. When the negative is dry make a contact print on another film to get a positive. Then develop the latter in regular developing solution. When dry, place the two negatives face to face and

there you have the subject in relief. Hold the negatives in position with adhesive tape so they cannot shift and make prints either by contact or projection.

—John G. Roberts, Chicago.

Screw Holder of Stiff Wire Saves Time

The next time you have to start a screw in a place that is hard to reach, just take a minute to bend this holder from a piece of stiff wire. Slip it under the head of the screw and you can guide it into the hole with little trouble.—Opie Read, Jr., Chicago.



Simple Sand Bath for Chemists

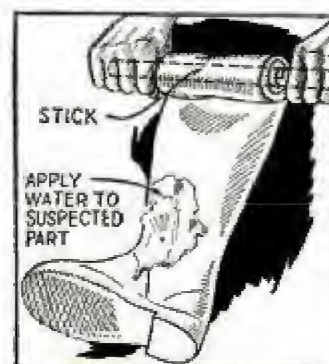


Here's a sand bath, for heating vessels indirectly, that any amateur can make at practically no cost. It consists of a cigarette tin fitted with legs of flat iron to raise it high enough to slip a Bunsen

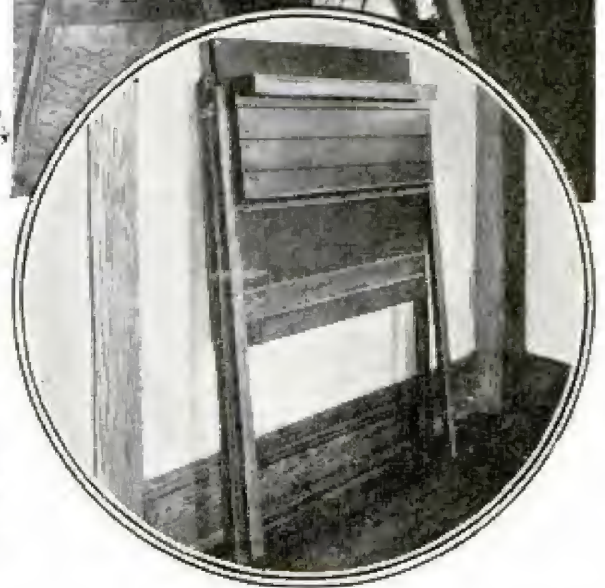
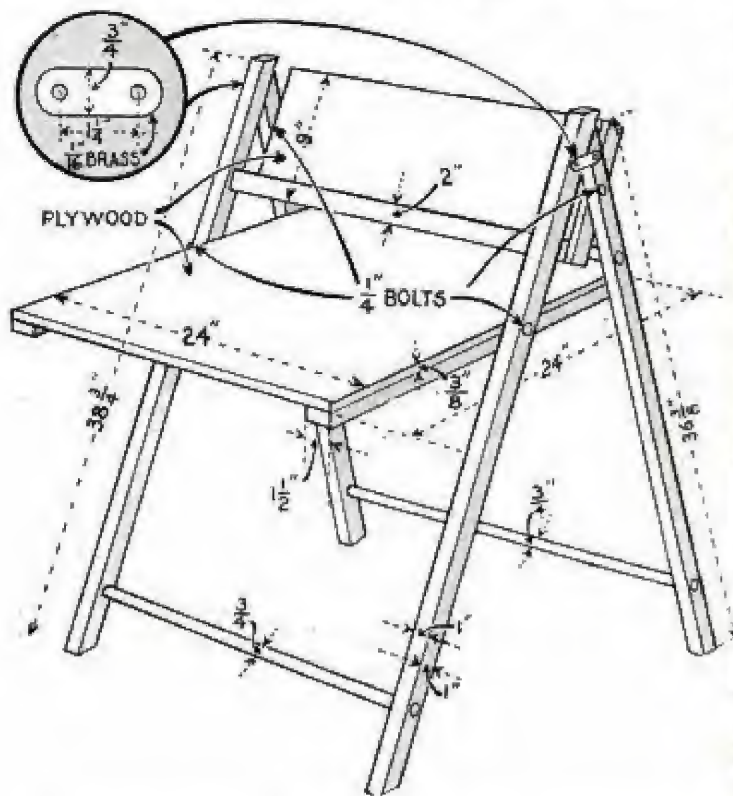
burner under it. The legs can be fastened to the bottom of the tin with rivets.

Locating Leaks in Wading Boots

When wading boots develop pin-hole leaks that are hard to locate, moisten the rubber over the suspected area with soap-suds. Then roll the upper leg of the boot on a broomstick to compress the air. The pressure will cause small bubbles to appear over the leaking spots which then may be marked for repairs.

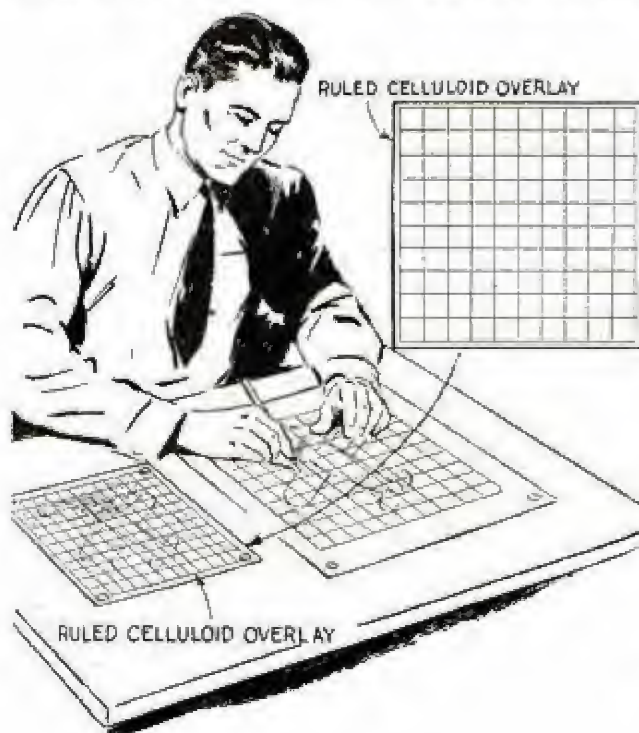


Portable Study Desk Is Stored Behind a Door



For use with almost any chair, this sturdy, folding student's desk can be tucked away in a jiffy. It has a bookrack with a ledge high enough to hold a book open and to accommodate pencils. There is sufficient space between the rack and the desk top to permit papers to slide to the rear, out of the way, when not in use. The top, made of plywood, bears up against a dowel crosspiece between the rear legs. To fold the desk, the bookrack is turned over so that the ledge is uppermost, after which the desk top is turned and the legs brought together.

Sketch Photos or Drawings with Aid of Ruled Celluloid

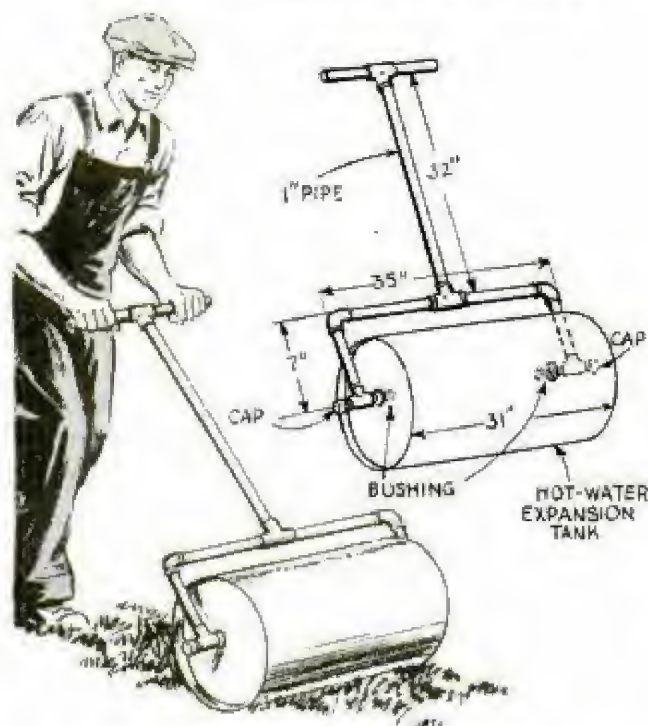


It is a simple job to copy a picture the same size or larger than the original, if you use a piece of celluloid ruled off in squares. This is placed over the picture to be copied, after which the sheet of paper on which the sketch is to be made is also ruled off in squares. However, the size of these is determined by the amount of enlargement. For instance, if the celluloid is ruled off in 1/2-in. squares and the picture is to be reproduced twice the original size, the paper should be ruled off in 1-in. squares. Then, you proceed in sketching, and the ruling will serve to locate accurately the lines to be drawn.

—M. G. Winterton, Ft. Lewis, Wash.

❏ Paper on the backs of pictures, to keep out dust, should be renewed as soon as it has become torn.

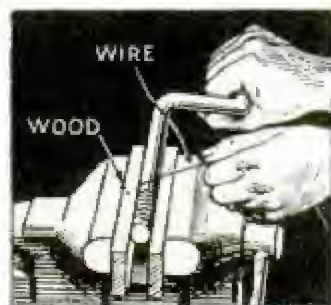
Hot-Water Expansion Tank Makes Handy Lawn Roller



Using a few pieces of 1-in. pipe, four tees and a discarded expansion tank you can easily make up an efficient lawn roller. A screw bushing is turned into each end of the tank, using pipe-thread compound to prevent leakage of water. Tees slipped over the bushings act as bearings for the handle. To fill the tank you simply remove either one of the caps on the bushings and insert the hose. Any small holes in the tank can be plugged with copper wire and soldered.—I. D. Linehan, Chicago.

Simple Mandrel to Wind Springs

For winding a number of springs I use a simple crank shaped from an iron rod. This is placed between two soft-wood blocks clamped in a vise, after which the end of the wire from which the springs are to be wound is inserted into a hole in the end of the crank. Then, the latter is rotated slowly to wind the spring, taking care to space the wire turns correctly. As the work progresses, the wire cuts tiny grooves in the blocks like threads. Duplicate springs then



can be wound rapidly, as the grooves in the blocks guide the wire and space it automatically as the crank is turned slowly.

—J. F. Dockar, Vancouver, B. C., Can.

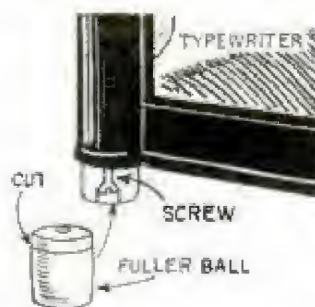
Building Paper Applied Easily with Scaffolding in Place

Instead of loosening scaffolding braces from the side of a building when applying paper, leave the scaffolding in place and cut a slit in the paper to slip over the braces as shown. When the scaffolding is removed, the flap can be tacked down.



Replacing Typewriter Cushions

Old, hardened rubber cushions on the feet of a typewriter can be replaced with ordinary fuller balls obtainable at a local variety or plumbing store. Cut off tops as indicated and insert screw bolts in the holes. Upon tightening the screws, the heads will become deeply sunk into the rubber, thereby providing neat and durable cushions. —Morris Clayton, Nowata, Okla.



Emergency Lead-Pencil Clip

An emergency pencil clip is quickly improvised by fitting the pencil with a common "socket" eraser and slipping a wire paper clip under it as shown. If the lower end of the wire is bent upward slightly, it will slide over the edge of a pocket easily.

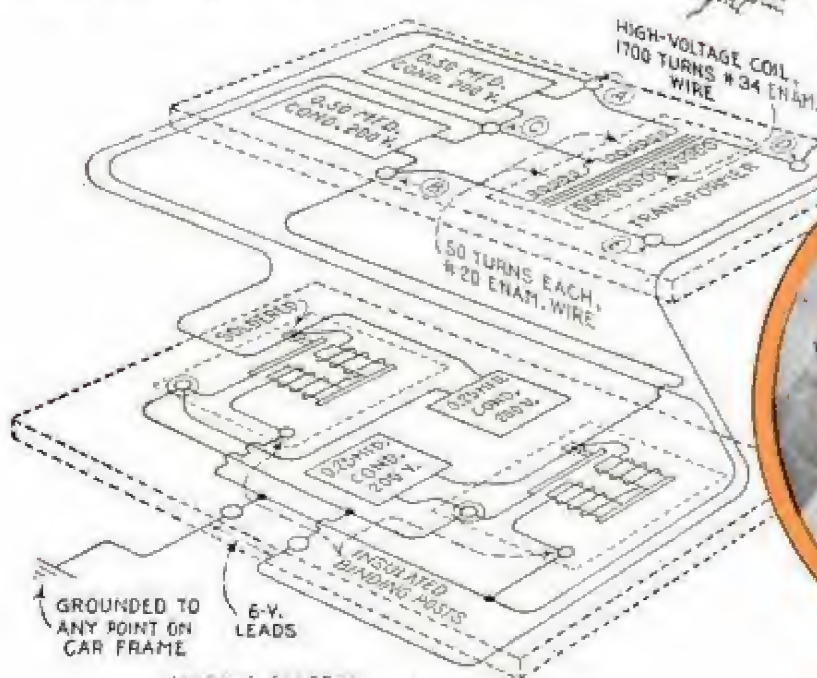


VACATION SHAVING

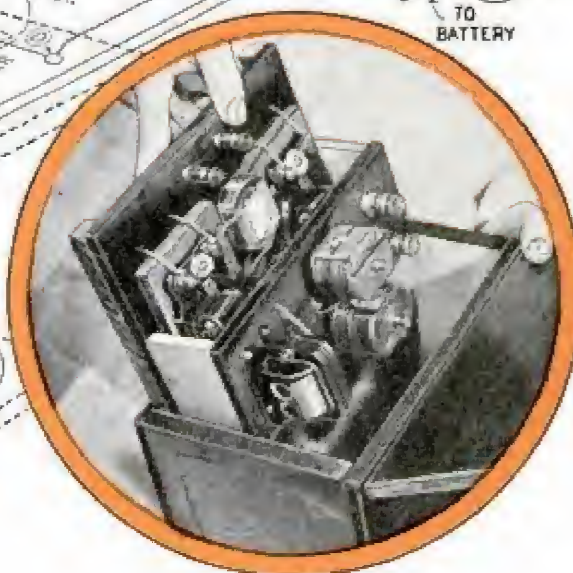
from a car battery

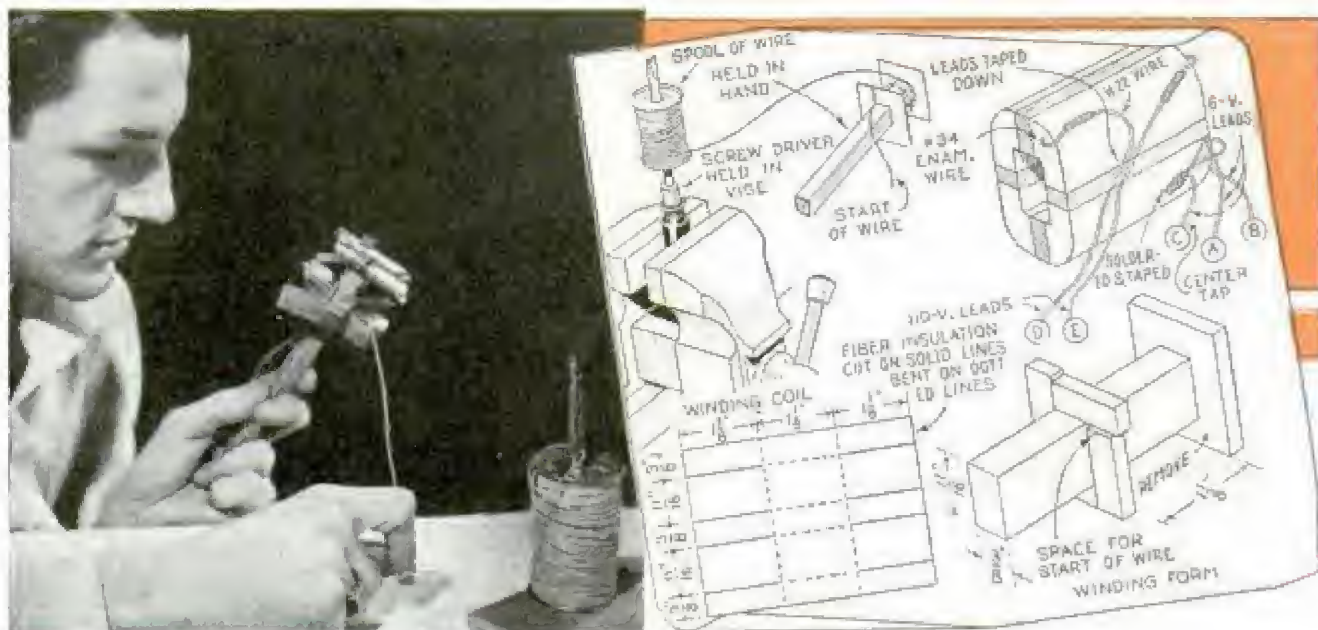
WITH this compact and easily built outfit, tourists, "trailerites," and traveling men can operate their 110-volt electric razors from the 6-volt car storage battery at a current not exceeding 6 amps. All you need is a couple of door buzzers, a bell transformer, which you rewind, a few condensers, switch, plug outlet and wire. The parts are mounted on a panel which is slid into a box, the top of which has a plug outlet and switch. Cables from the unit to the battery pass through holes in the side of the box or they may attach to binding posts on a small Bakelite panel on the side of the box.

The transformer core is taken from a doorbell transformer. The cores for most transformers of this kind are $\frac{5}{8}$ by $\frac{1}{16}$ in. in cross-sectional area and have a winding space $1\frac{1}{4}$ in. long, and the values given for rewinding are based on these figures; however, any bell-ringing transformer will do, provided the same number of turns are used and the wire sizes specified are adhered to. After the case has been removed from the transformer, all of the old windings are stripped off.



WIRING DIAGRAM





A winding form having dimensions to suit the core and 8 or 10 in. long is made from wood. Strips of cotton tape are laid lengthwise along the form and covered with a piece of fiber or heavy brown paper cut to the shape shown in one of the details. This is held in place with a single band of friction tape. The 110-volt coil is wound with 1,700 turns of No. 34 enameled wire evenly distributed. Cotton-covered wire cannot be used as there is not enough space. Under no circumstances can smaller (larger gauge number) than No. 34 be used for this coil. No insulation is needed between layers. When the coil is finished, a 12-in. length of wire should be left for connections, and the coil covered with a layer of brown paper. Then the low-voltage coil is wound over the 110-volt winding with No. 20 enameled wire, two coils of fifty turns each being required. These can be wound at the same time from two spools of wire. The start and finish ends of each coil must be marked carefully so that they can be connected properly after winding.

When these coils have been wound, the ends of the cotton tapes are tied over the coil unit to hold it together, and it is slipped off the form. A single turn of friction tape is wrapped around each of the four sides of the coil to hold it together permanently. The ends of the high-voltage coil should be soldered to lengths of No. 22 or No. 20 cotton-covered wire to prevent possible breakage of the fine wire. The joint must be made close to the coil, and

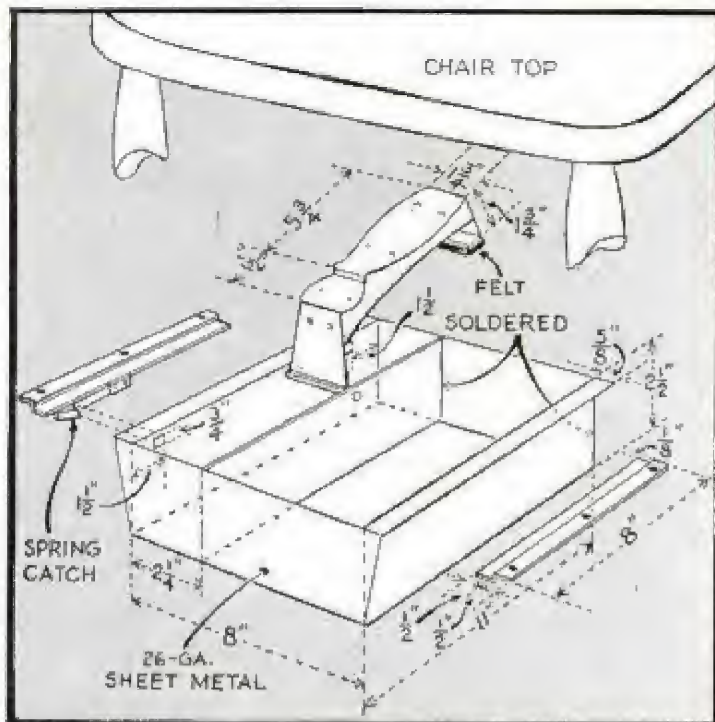
then the connection should be insulated and taped down to the coil to prevent any sudden jerk from snapping the wire. The finish end of one of the low-voltage coils and the start end of the other low-voltage coil should be soldered together and a sufficient length of wire left to facilitate connections. This center-tap should be marked "C" for identification. The other ends of the low-voltage coils are marked "A" and "B." It makes no difference which is marked "A" and which "B." The laminations are slipped into the coil alternately from the two ends exactly as they were originally, and the transformer case is put around the transformer and bolted tightly. The five leads to the coils should be brought out through the porcelain bushings which were used on the original transformer.

The parts of the unit can be mounted very compactly as shown. Bakelite is used for the panels. The condensers shown are 200-volt radio condensers of the capacities indicated. The buzzers are mounted on sponge rubber to cut down the noise as much as possible.

Completing Interrupted Card Deal

If you are interrupted while dealing cards, and forget where you stopped, try the following method to complete the deal correctly. Begin with yourself and deal out the balance of the deck, going around the table in the opposite direction and taking the cards from the bottom of the deck.

Shoe-Shining Box Slides under Chair Seat

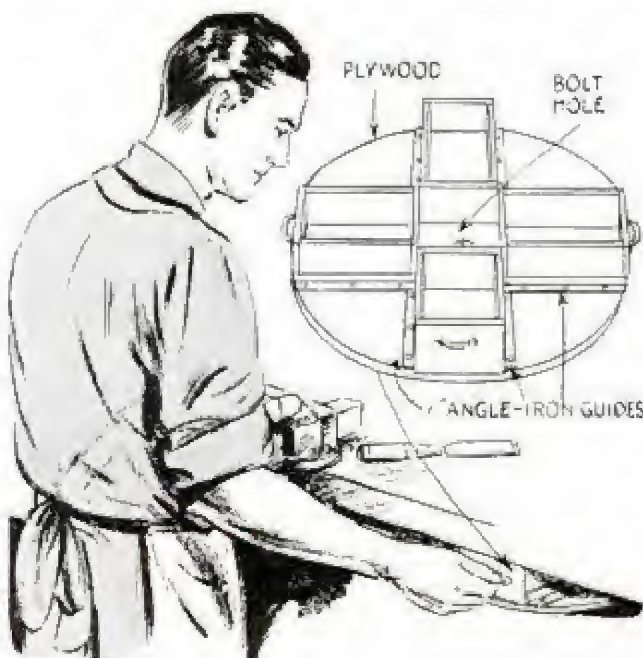


Sliding in two rails screwed to the underside of a chair, this box slides forward for ready access to the contents when needed, and a wooden footrest then can be swung over on the chair seat. The footrest is pivoted between one side and a partition of the box and has a piece of felt on the end that contacts the chair seat to avoid marring it. The tray can be made up of sheet metal or wood as desired. One of



the slides is provided with a spring catch to keep the tray in the closed position, and a stop may be added to prevent it from sliding out and dropping on the floor.

Rotating Drawers Save Space Underneath the Workbench

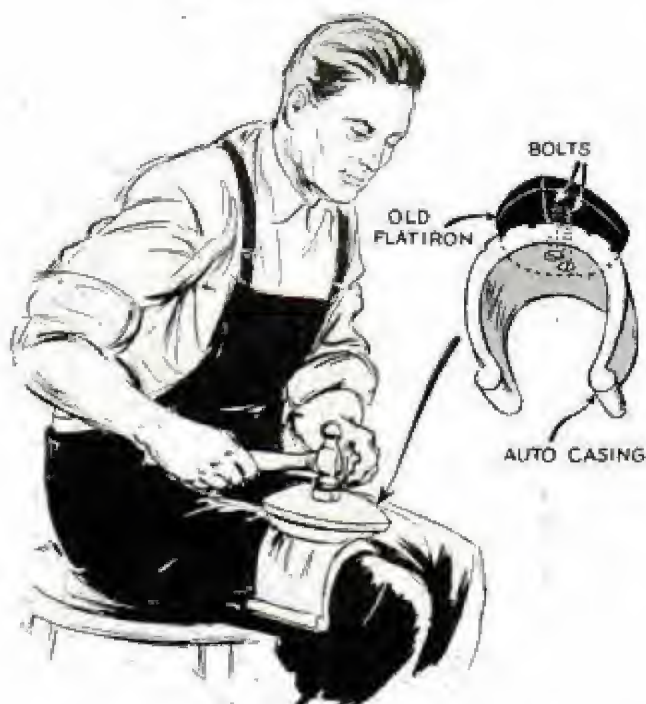


When space is limited under a work-bench these rotating drawers will help solve the problem. Also, they can be reached from either side by turning them to bring the one desired in front. The drawers are assembled on a large plywood disk having a diameter approximately equal to the width of the bench. The disk is pivoted in place with a strong bolt and washers, and the drawers slide between angle-iron guides screwed to it. If the disk tends to tip due to unequal loading, an X-frame of light stock can be suspended from the bench underneath it to provide the necessary support on the heavy sides.

—Lowell C. Ferguson, Spokane, Wash.

●Screw a metal broom holder to the top of your ladder for holding a screwdriver.

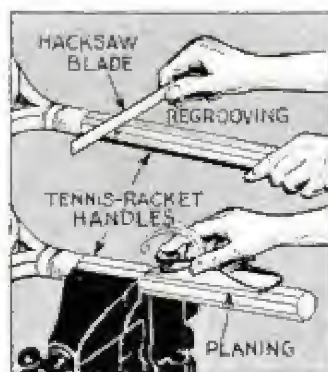
Small Anvil from Flatiron Clamps to Leg



A handy little anvil, that may be held securely on one's leg, is made by attaching a discarded flatiron to a short section of auto casing. The flatiron is drilled and tapped to receive two small stud bolts or large machine screws, the heads of which will sink into the fabric of the casing as they are tightened.

Tennis Rackets Are "Tailored" to Measure

Unless the handle of your tennis racket fits your hand and has the proper "feel," you are not likely to play your best game.

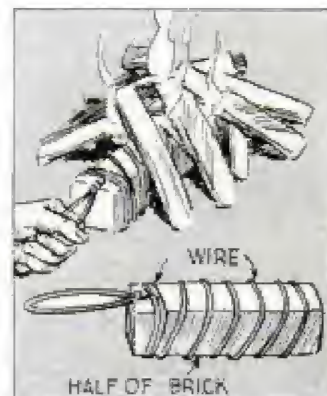


Usually the handle is too large which causes muscular strain and slows you down. This does not mean faulty manufacture, as the sizes must be standardized. The handle of a man's racket usually measures $4\frac{3}{4}$ in. in circumference at the butt and you can reduce this safely by careful planing to $4\frac{1}{2}$ in. or any size in between that fits your hand. The feel of the racket must be determined by trial during the planing operation.

When it's just right, you duplicate the original grooved surfaces by drawing a hacksaw blade over the flat surfaces with the grain.—D. J. Gaul, Bridgeport, Conn.

Brick Soaked in Kerosene Kindles Fire

You'll have no trouble starting a fire at camp, in a stove or in your fireplace, if a soft brick soaked in kerosene is used. It's best to split the brick in half and wrap it with heavy wire to provide a handle.



Shields under Paper Fasteners Prevent Ragged Holes



Punched holes in papers held together with small brass fasteners are prone to become worn and ragged, especially those in the top and bottom sheets, so that the papers finally tear

loose. This trouble can be avoided easily by folding a $\frac{1}{2}$ -in. strip of celluloid or tough cardboard over the paper before punching each hole.

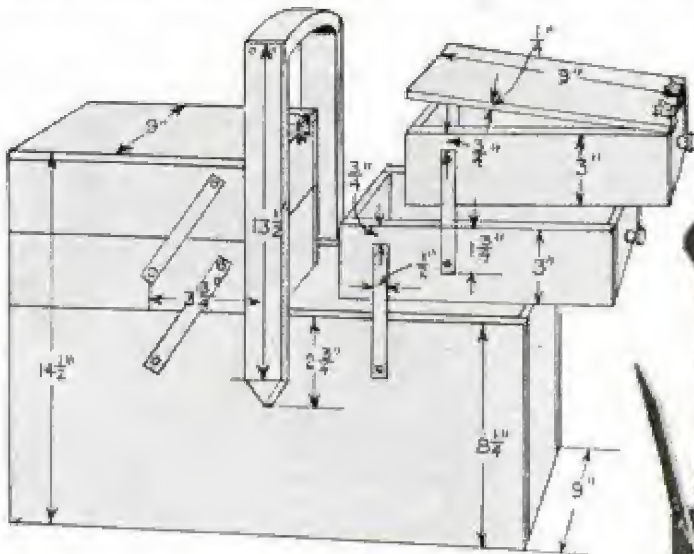
Bottle Stoppers from Erasers

Rubber corks for small chemical bottles in the laboratory may be had by using pencil erasers of the type shown. The hollow end compresses easily to slip into the mouth of a bottle.



❏ Poached eggs will not stick to a saucepan if the bottom has been rubbed with oil.

Pivoted Trays on Sewing Box Show Contents



Swinging the pivoted trays of this sewing box outward makes everything readily accessible to the home seamstress. Plywood is used throughout except for the handle and the strips of metal on which the trays pivot. The strips, all of the same length and drilled identically at the ends for screws, must be located at an angle and parallel to each other, as shown when the trays are in the closed position, so the trays will not bind when moving them over to rest snugly together when in the open position

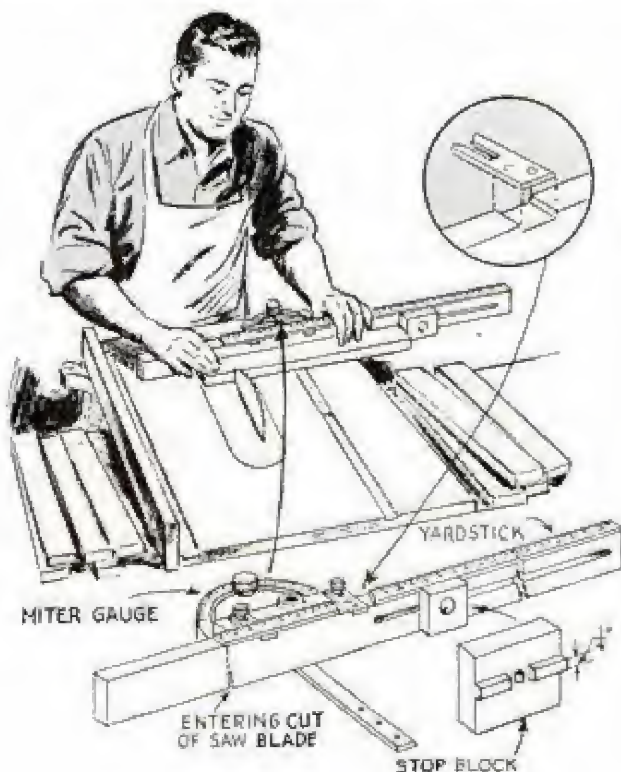


Auxiliary Straightedge on Miter Gauge of Circular Saw

Quickly attached or removed at will from the saw miter gauge by means of metal clips as shown, this auxiliary straightedge has a convenient scale by which to set an adjustable stop block. A

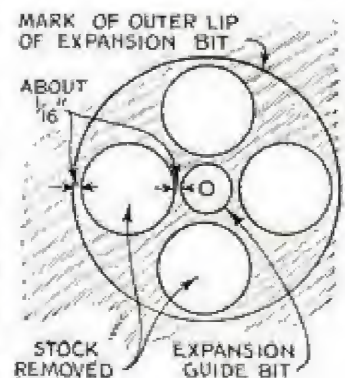
length of $\frac{3}{4}$ -in. stock, preferably plywood, is cut to fit flush with the top of the face of the gauge and is slotted to receive the tongue of the stop block. The block is held securely at the desired position by a wing nut conveniently located on the back side of the beam.

—Wayne C. Leckey, Aurora, Ill.



Using Expansion Bit in Hardwood

You can ease the strain on an expansion bit when boring hardwood if you first remove some of the waste stock. To do this, drill a tiny pilot hole in the work for the screw of the expansion bit. Then run in the



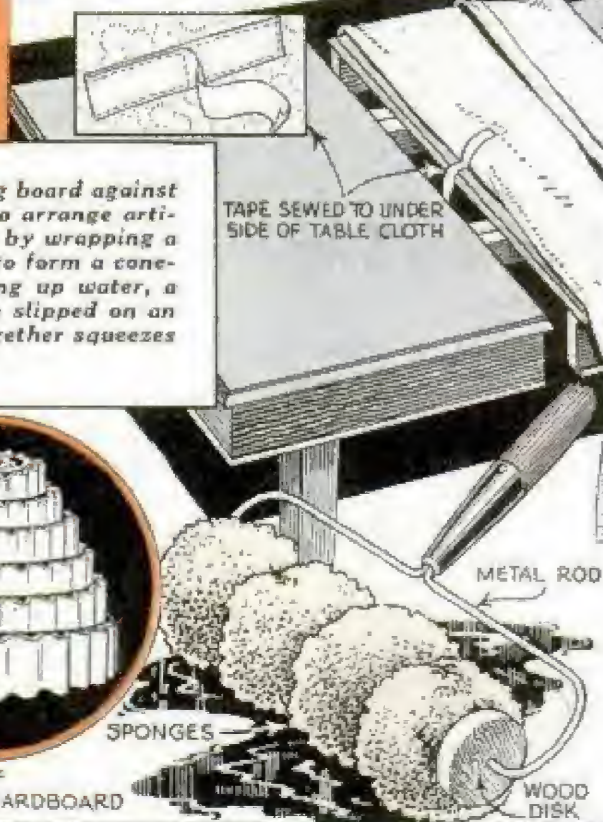
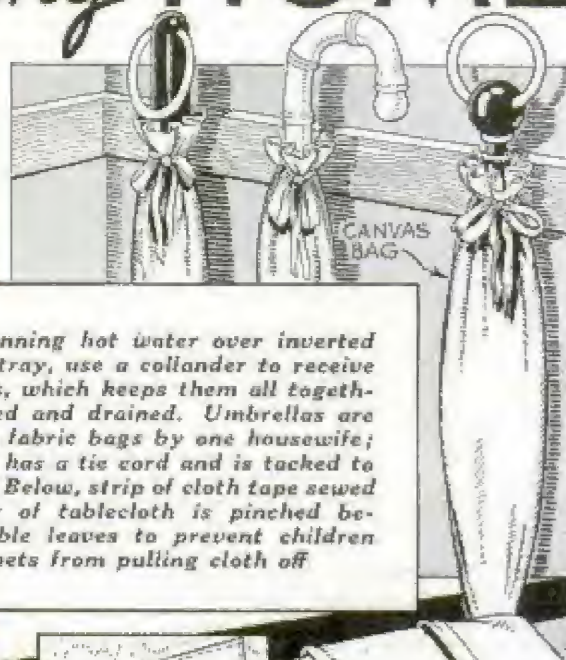
latter until the outer cutting lip outlines the hole to be bored. Next bore four holes inside the circle formed by the bit as indicated in the drawing.

—Donald B. McElroy, Bloomington, Ind.

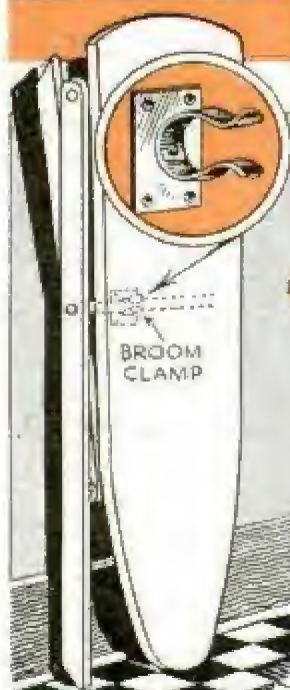
Solving HOME



While running hot water over inverted ice-cube tray, use a colander to receive the cubes, which keeps them all together, washed and drained. Umbrellas are stored in fabric bags by one housewife; each bag has a tie cord and is tacked to the wall. Below, strip of cloth tape sewed to center of tablecloth is pinched between table leaves to prevent children or pets from pulling cloth off

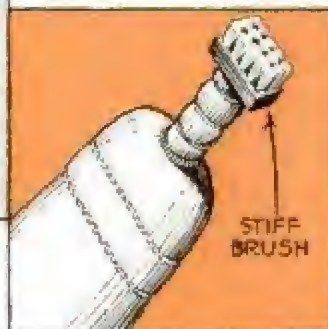


Left, broom clamp holds ironing board against wall in crowded closet. Frog to arrange artificial flowers is quickly formed by wrapping a strip of corrugated cardboard to form a cone-shaped roll. Right, for mopping up water, a few sponges and two disks are slipped on an iron rod. Pushing the disks together squeezes out the water



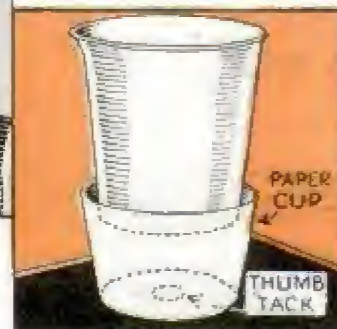
Lemons in tightly sealed jar in refrigerator do not dry out quickly

Tiny stiff brush on handle of whisk broom aids spot removal

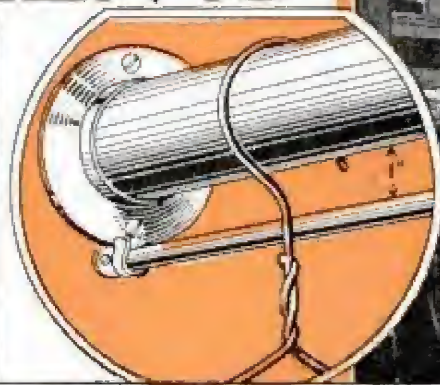


A little starch in window wash water helps produce luster

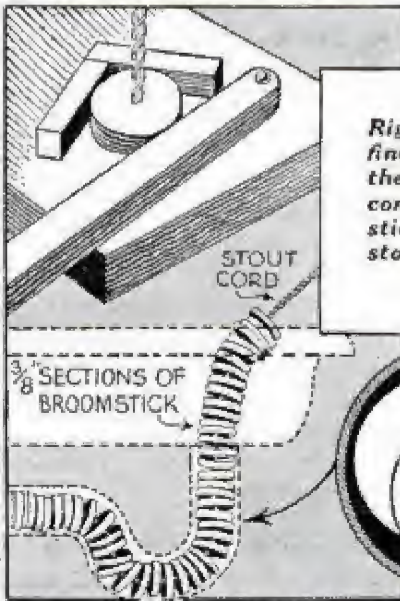
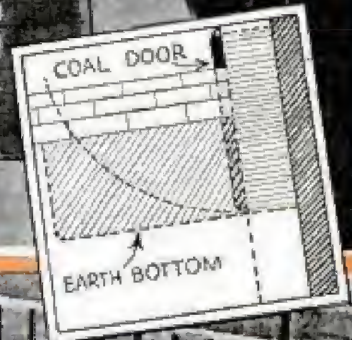
Keeping tumblers from overturning on card table



PROBLEMS



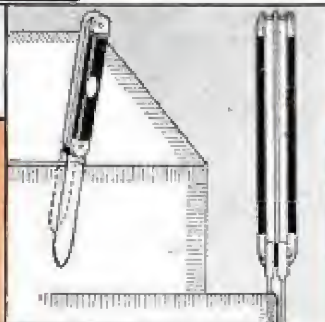
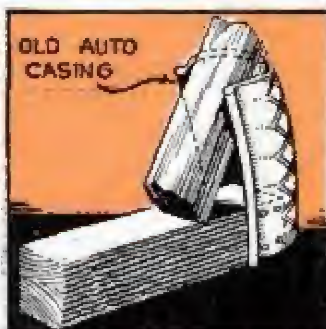
Lowering of stubborn upper sash eased by two hand grips. Rod under clothes-hanger pole prevents hangers from swinging off when clothes are removed quickly. As an aid in squeezing out contents of small tubes, try a clothespin



Right, recess in front of coal door confines dust when delivering. "Snake" on the left to keep sink drain pipes clean consists of 3/8-in. disks cut from broomstick, drilled off center and strung on stout cord; it scrapes the entire inside surface of the pipe

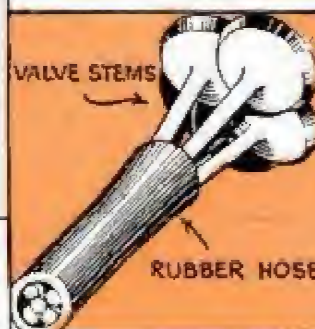


Piece of auto casing supports wood on chopping block



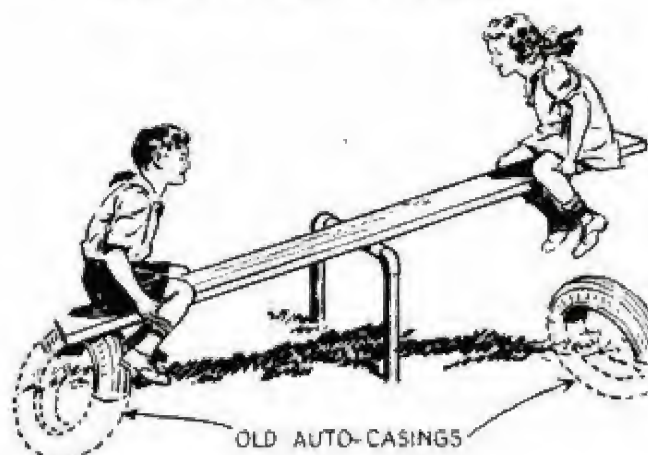
One knife blade guides other to cut along edge of paper box

Valve stems stuck in hose to form scraper for furnace flues



Asphalt shingle under ladder avoids slipping on smooth floor

Auto-Casing Bumpers on Seesaw Protect Children's Legs

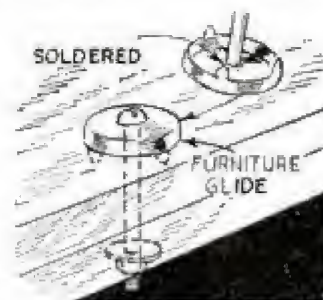


As an aid in sitting on a seesaw, children often bring their legs well under it with the result that they are sometimes injured when the ends of the seesaw strike the ground. To avoid this, an old auto casing

can be set into the ground under each end of the board at an angle as indicated. The casings also absorb the shock.

Neat Washers on Bolt Heads

As a means of ornamenting exposed bolt heads on display cabinets and the like, fancy looking washers can be provided simply by drilling furniture glides through their centers. Where a smooth headed bolt is used, the glide may be soldered to it as shown. This will keep the bolt from turning when drawing it up, as the prongs will imbed in the surface of the work.



Colonial Footstool *adds to arm-chair comfort*

Readymade, removable cushion attached with snaps. Easy enough for beginners in handicraft, yet attractive enough for advanced woodworkers. Only a few hand tools required. Complete information, plans and photos for only ten cents



Four short, tapered legs glued and keyed into a top to which a comfortable cushion is fitted

EASY TO MAKE

All there is to the construction and assembly is the attachment of four tapered legs to the top, rounded ends of the legs being glued and keyed with a wedge in four slanting holes, bored with the aid of a simple jig. Finishing is no trouble at all and the completed stool is a worthwhile and extremely practical article for the average home that any craftsman will enjoy making.

DETACHABLE CUSHION

A standard cushion of your own choice, which you purchase, is the same size as the top of the stool. Straps sewed on the underside of the cushion are passed through slots in the top of the stool and are tacked or snap-fastened to the underside to keep it in place, yet permit quick removal when necessary for cleaning.

CRAFTPLAN SHOWS HOW

Just send ten cents to get a Craftplan for making this project, which gives dimensioned drawings and details, includes photos picturing several steps, and explains just how to go about the work, step by step. Use the coupon so you will get the Craftplan promptly.

POPULAR MECHANICS MAGAZINE
200 E. Ontario St. Chicago

Enclosed find 10 cents for Craftplan No. 3002 on
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Use pencil

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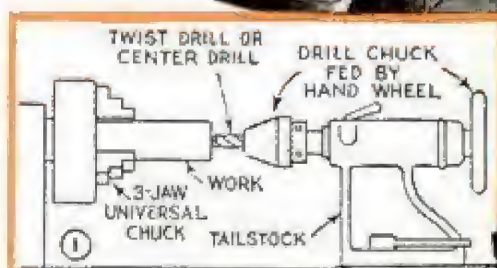
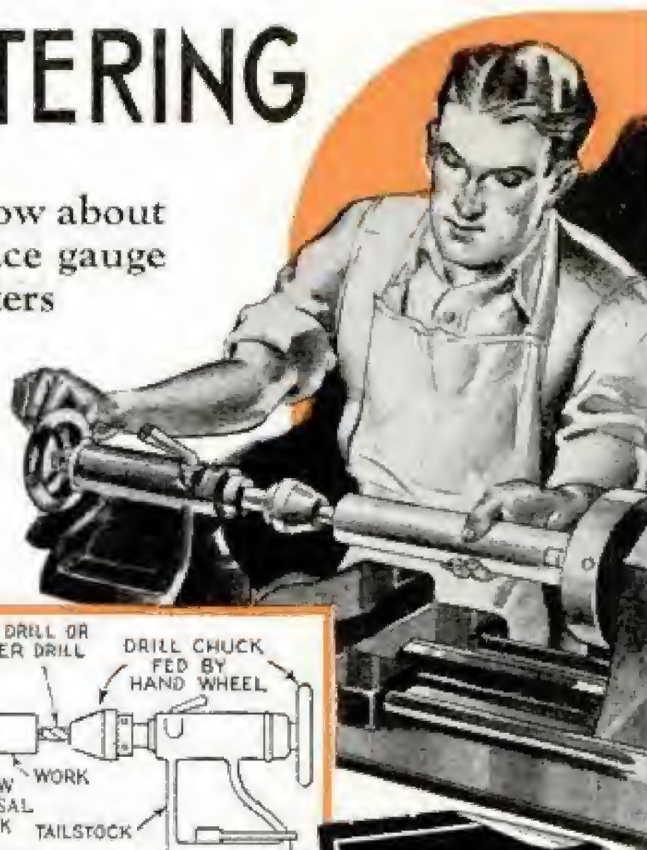


CORRECT CENTERING

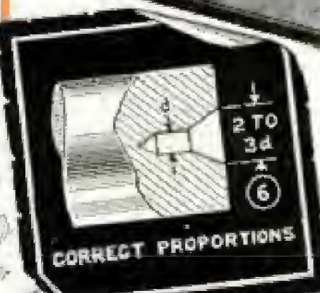
What every lathe owner should know about using calipers, center square, surface gauge and bell punch to locate centers

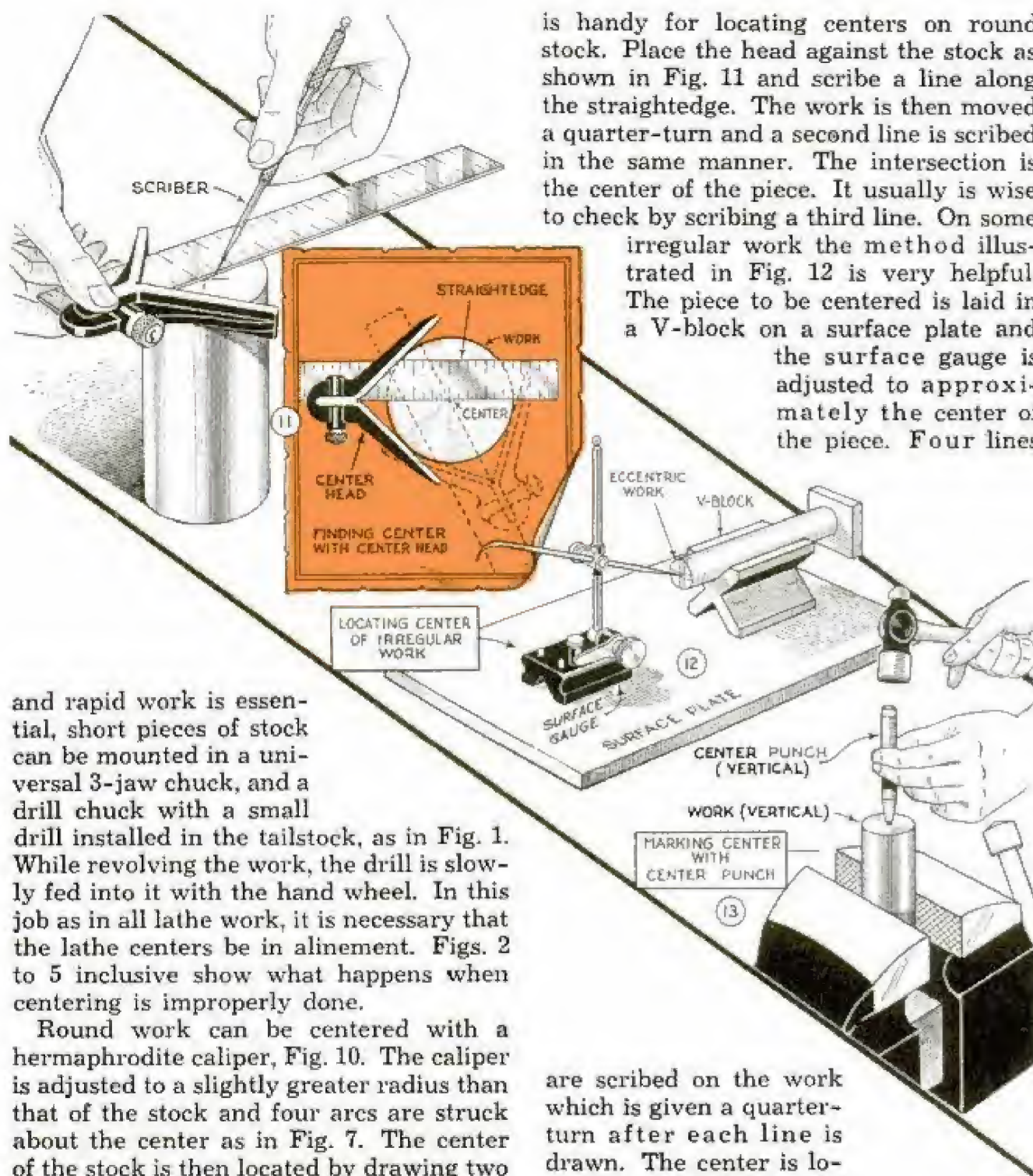
ACCURATE turning of both round and square work begins with proper centering. Tool steel and cast iron in particular must be centered accurately, the former to assure that the decarbonized surface layer is removed completely so that the steel can be hardened properly, and the latter so the tool will cut through the scale and not be dulled by this hard surface layer.

Methods of Locating Centers: While a centering machine is generally used in large shops, small shops must use hand methods. Where great accuracy is not required



CENTERING CHUCK AND DRILL METHOD





and rapid work is essential, short pieces of stock can be mounted in a universal 3-jaw chuck, and a drill chuck with a small drill installed in the tailstock, as in Fig. 1. While revolving the work, the drill is slowly fed into it with the hand wheel. In this job as in all lathe work, it is necessary that the lathe centers be in alignment. Figs. 2 to 5 inclusive show what happens when centering is improperly done.

Round work can be centered with a hermaphrodite caliper, Fig. 10. The caliper is adjusted to a slightly greater radius than that of the stock and four arcs are struck about the center as in Fig. 7. The center of the stock is then located by drawing two diagonals cutting the intersections of the arcs, Fig. 7. In order that fine scribed lines can be seen clearly, a solution of copper sulphate in water is applied to the steel with a wad of cotton or a rag, as shown in Fig. 9, until a copper coating forms. Clear lines can be scribed on this surface with very little pressure. Another method is to coat the end of the stock with chalk. The center of rectangular stock is located by drawing two diagonals across the end, as shown in Fig. 8. The intersection of these lines is the center of the piece.

The center head of a combination square

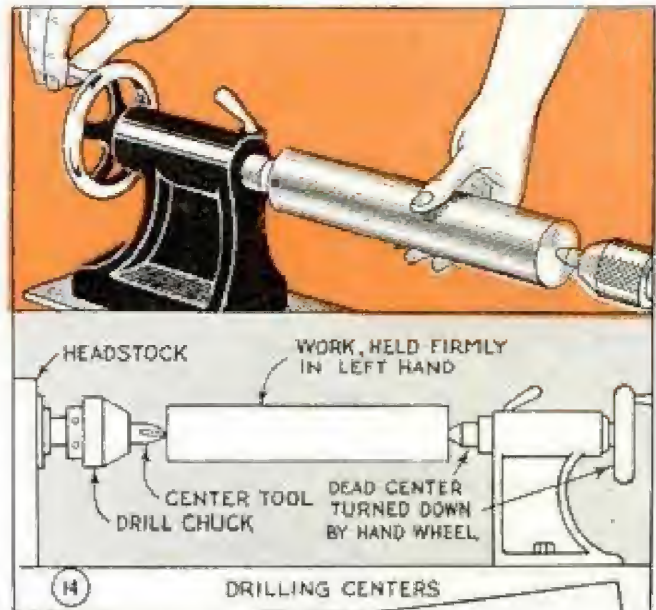
is handy for locating centers on round stock. Place the head against the stock as shown in Fig. 11 and scribe a line along the straightedge. The work is then moved a quarter-turn and a second line is scribed in the same manner. The intersection is the center of the piece. It usually is wise to check by scribing a third line. On some irregular work the method illustrated in Fig. 12 is very helpful. The piece to be centered is laid in a V-block on a surface plate and the surface gauge is adjusted to approximately the center of the piece. Four lines

are scribed on the work which is given a quarter-turn after each line is drawn. The center is located by the diagonal-line method, and the center of the other end is found in the same way.

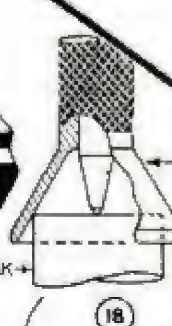
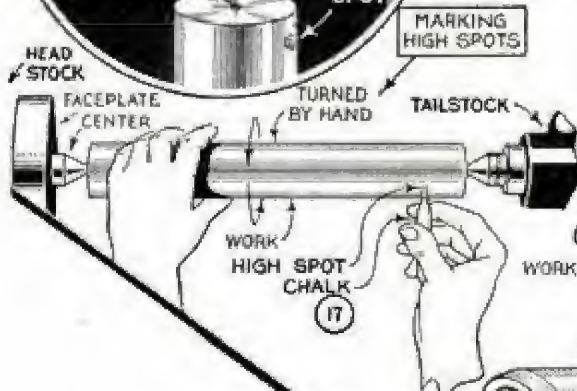
Center Punching: After the center has been located, the work is clamped in a vise and the center is marked with a center punch and a hammer, as shown in Fig. 13. After both centers have been center-punched, the work is placed in the lathe and turned by hand, marking any high spots at either end with chalk, as shown in Fig. 17. The piece is replaced in the vise and tapped again with the center punch, which is driven toward the high spot to

"drift" the mark to the central point, as shown in Fig. 16. Finish the indentation by driving the punch vertically. Test again between centers and repeat if necessary until tests show that the indentation is truly centered. Unless extreme accuracy is required, use a bell center punch, Fig. 18. This tool will locate centers on round stock in one operation with sufficient accuracy for ordinary work. Simply place it over the end of the stock and strike the plunger lightly with a hammer.

Drilling the Centers: The center can be formed in one operation with the center drill shown in Fig. 14, or in two steps with a drill and reamer. Three types of centering tools are shown in Fig. 19. The upper detail shows the combination center drill while the lower-right detail shows two types of center reamers. Drill and reamer sizes for work of various sizes are given in Fig. 15. The centering tool or reamer should match the center being used, that is, a 60° reamer for the regular 60° lathe center. To use the combination center drill, mount the work as in Fig. 14 with the centering tool chucked in the live spindle of

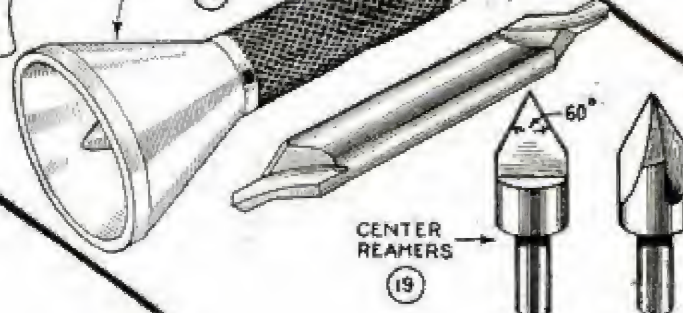


SIZES OF CENTERS		
Diameter of Work in Inches	Diameter of Center (Countersink) in Inches	Diameter of Center Drill in Inches
3/16 — 5/16	1/8	1/16
3/8 — 1	3/16	3/32
1 1/4 — 2	1/4	1/8
2 3/4 — 4	5/16	5/32



the lathe. Feed with the tailstock while the lathe is running at its highest speed, holding the work as shown to prevent its turning. The drilled hole always should be from $\frac{1}{8}$ to $\frac{1}{2}$ the diameter of the reamed hole, as indicated at d in Fig. 6. For steel or wrought iron, lard oil or a cutting compound should be used to lubricate the drill. Cast iron is always drilled dry. If a drill and reamer are used to form the centers, the operation is the same, except that it is performed in two steps. A lead hole of the proper size, Fig. 15, is drilled first. Then it is reamed to the proper diameter using a center reamer of suitable size.

The bell center punch at the right offers the quickest means of centering small round stock where precision is not required. It will center-punch stock of varying diameters

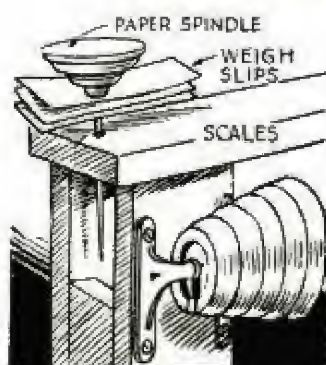


Wheeled Stands Display Goods in Front of Store



The problem of moving stands of merchandise from the front of the store to the inside at the end of the day, or in case of sudden rains, is solved by providing the stands with casters. The large rubber-wheel type is best for this purpose. Or, small cart wheels on axles attached to the bottom of the stands, will serve the purpose, although they do not give as much flexibility of movement as casters.

Weigh Slips on Outside Scales Held Safely in Wind



Instead of the usual method of setting a spindle paper file on the arm of a scale, one produce buyer drilled a hole through the arm to receive the spike of a paper

spindle, as shown. The slips impaled on the spindle are thus held against any possible loss by wind, and the spindle is easily removed for further additions.

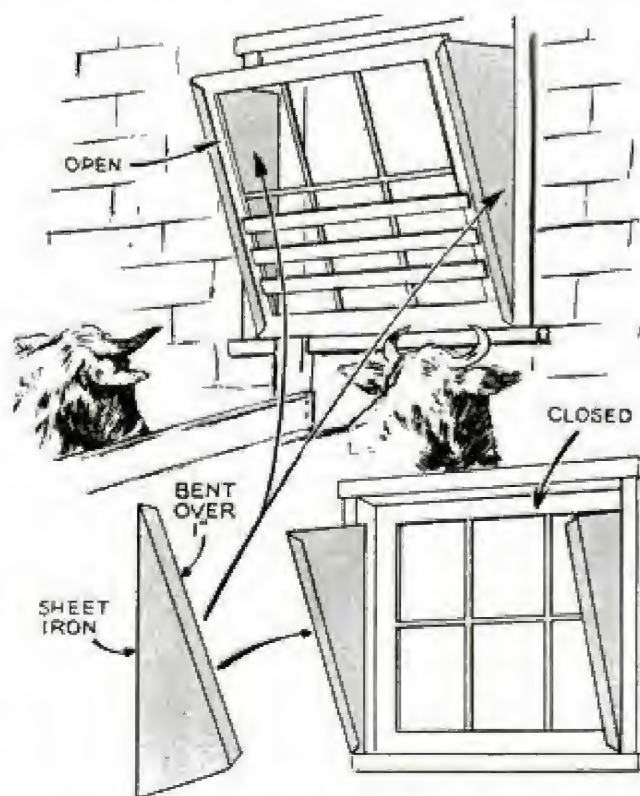
Handle on Rubber Stamp Pad

To simplify opening a rubber stamp pad, cut the wooden handle from a discarded stamp block and attach it to the center of the pad cover. This allows the pad cover to be lifted easily and saves time and trouble when you are in a hurry.



Draftless Ventilation in Barns

Draftless ventilation in some dairy barns near Lincoln, Nebr., is obtained by pulling the windows inward against sheet-metal triangles inverted and attached to the side frames of the windows. As illustrated, one



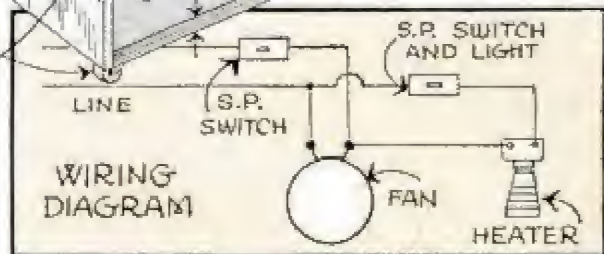
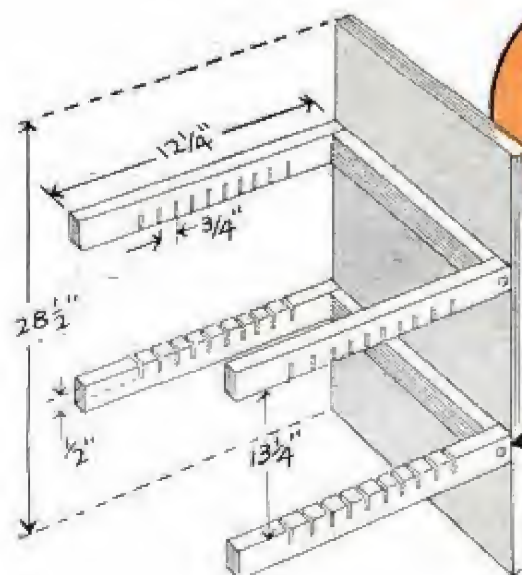
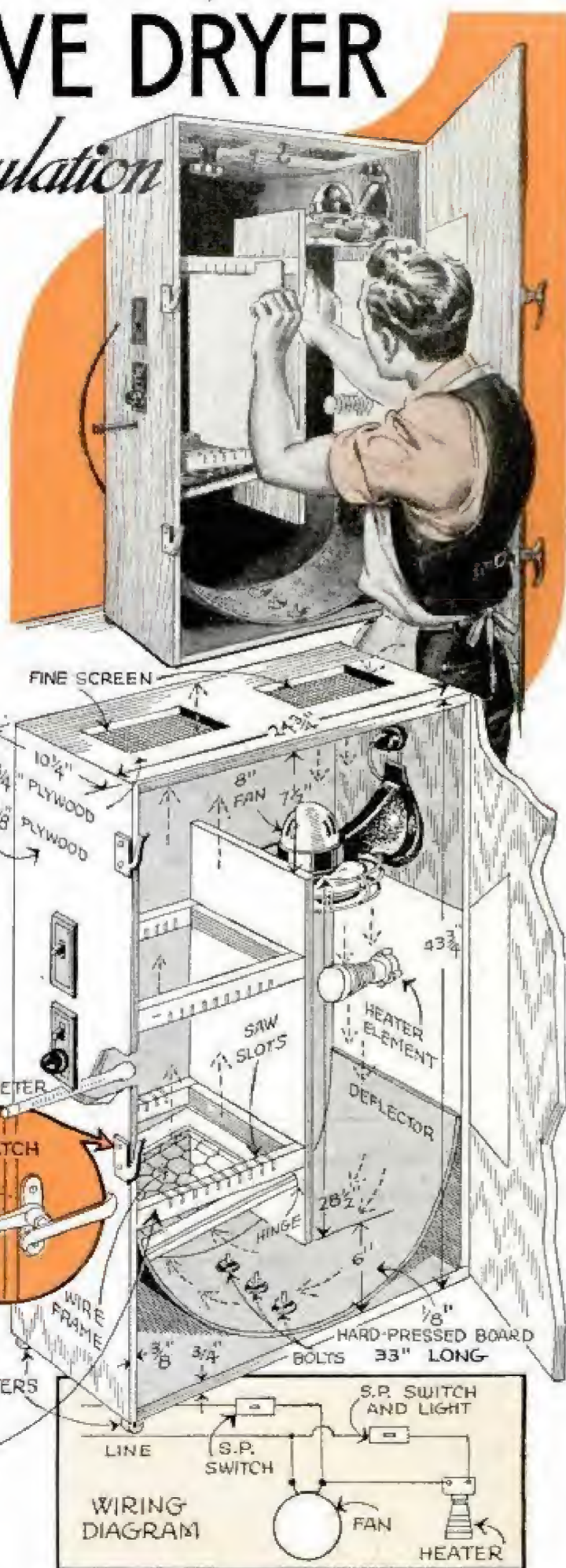
side of each triangle is bent over at right angles to serve as a stop for the windows. The incoming air flows against the windows and is deflected upward. Turnbuttons hold the windows closed.

This **NEGATIVE DRYER** *has warm-air circulation*

FOR quickly drying negatives and ferrotyped prints, this dryer takes little space. Air is forced through a U-shaped passage and may be warmed by an electric-heater element which may be turned on or off while the fan is running.

Plywood is used for construction. Sides adjacent the heating element are protected by asbestos paper. A piece of $\frac{1}{8}$ -in. hard-pressed board or sheet metal is bent to deflect the air around the center partition and up through the other side. Crosspieces hold ferrotype tins vertically. Cut films are suspended from spring clothespins attached to dowels, which are merely set across the crosspieces. A hinged frame covered with wire mesh is provided to catch the glossy prints. It is swung down to permit a 36-in. roll of film to hang from the top of the cabinet. The lower switch, which includes a ruby lamp, connects to the heating element. A thermometer is mounted beneath this lamp and extends into the cabinet.

—Myron Levee, Chicago.



Colored Lamps Summon Waiters to Restaurant Tables



Noticing that some of his patrons were annoyed at the delay in trying to catch the eye of a waiter, the manager of a large restaurant used a colored bulb in the cluster of each table fixture. The bulb was wired independently of the white ones and was operated by a pull chain from which a printed tag was suspended directing the patron to its use. It was an easy matter for the waiters to glance over the dining room and determine where their services were required. After answering the call, the waiter extinguished the lamp.

Chalk Substituted for Brush in Showcard Painting

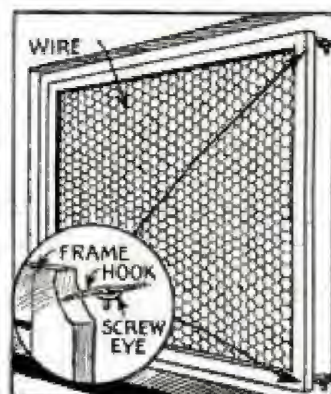


Showcard writers who have large paper posters to letter on short notice and who do not wish to take time to mix liquid colors, can turn out work of similar character and appearance by using colored crayons dipped in al-

cohol. Crayons so treated will work on almost any surface and the job may be accomplished in much less time. Water was also found effective but not as satisfactory as alcohol.

Wire Protects Factory Windows Against Breakage from Inside

In one manufacturing plant breakage made it necessary to protect certain windows from the inside. This was done by stretching medium wire mesh over light wooden frames. The latter were made removable by driving screw eyes into the window frames and registering L-hooks into the screens as in the detail.

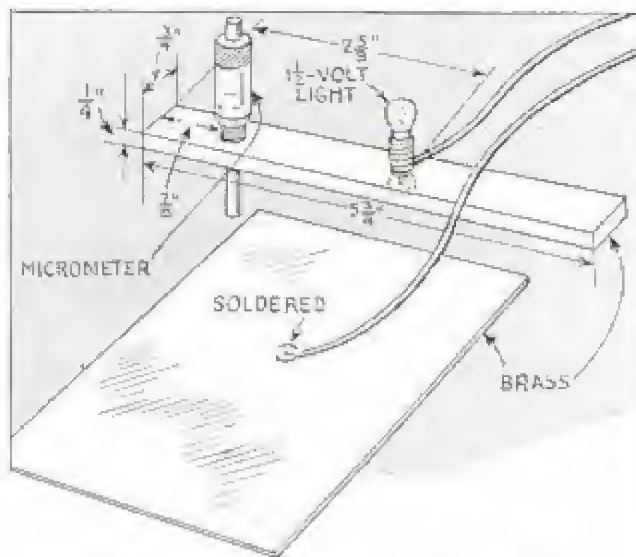


Heavy Cases on Loading Platform Moved on Two Push Trucks

Moving of heavy cases by means of two-wheeled push trucks saves time on one loading platform. The case is first rocked in the usual manner to get the edge of one truck under it, after which the other truck is slipped under the opposite end. Two persons can wheel the load and shift it around where desired.

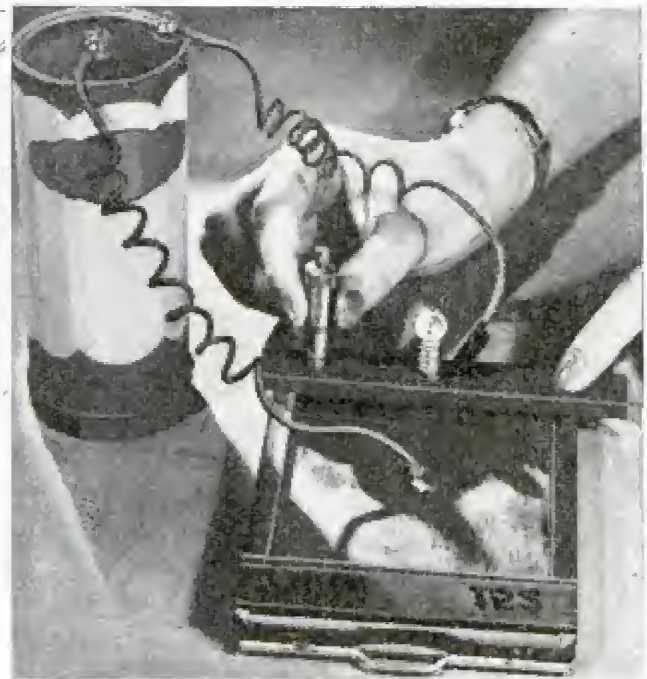


Lamp Lights on Plateholder Depth Gauge



FOR the color photographer who measures the depth of his plate and film holders, this homemade micrometer depth gauge with a flashlight indicator is accurate and saves considerable time. Whether the three-color negatives are exposed in sequence or simultaneously in a one-shot three-color camera, the plate or film holders must have exactly equal depth in order to assure images of the same size. Holders used in ordinary black-and-white photography are seldom accurate for color work. Hence when purchasing holders for color photography, the depth from the face of the plateholder to the surface of the plate must be measured accurately at all four corners, and holders are then selected in groups of three so that their respective faults will be similar.

To make this micrometer depth gauge, you get a piece of No. 16-gauge engravers' brass cut to the same size as the photographic plate, a strip of flat brass long enough to fit across the plateholder, a dry cell, 1½-volt flashlight bulb, some wire and a cheap micrometer. The drawing shows the assembly. After cutting off the arm of the micrometer, the shank is filed round, and the end of the shank is threaded to fit a tapped hole in the brass strip. A flashlight lamp is then attached to the brass strip so that one contact connects with the strip and the other one to an insulated lead which goes to the dry cell. Another lead from the dry cell is soldered to the brass plate. In use, the brass strip is laid across the plateholder as shown in the photo and the micrometer turned down

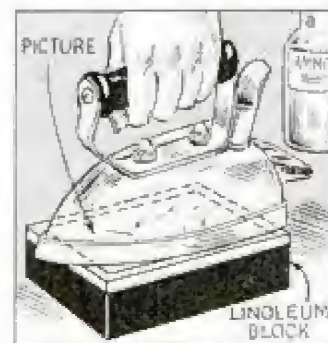


until the lamp lights. Naturally this visual method of indicating with a lamp when the micrometer touches the metal is more accurate than feeling with the fingers when the micrometer touches it.

—T. M. Hamilton, Chicago.

Ammonia to Transfer Pictures to Linoleum Blocks

When a picture is to be transferred from a newspaper to a linoleum block to make a



printing cut, moisten the picture with ammonia, lay it face down on the linoleum and weight it with an iron, so that the picture will be applied smoothly over the surface. Leave the weight in place for not

more than 5 min., then remove carefully and dry the block. The picture thus transferred to the linoleum will be the reverse of the original and will print a duplicate of the original picture.

☞ Stains caused by butter, fats and oils, can be removed easily from unwashable materials by sponging the spots with carbon tetrachloride.

Drawing Ink Applied to Pen from Bottle

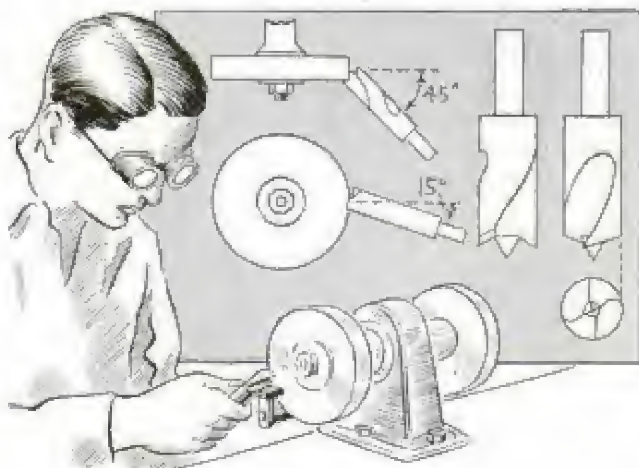


One draftsman found that by reversing the quill in the ordinary drawing-ink bottle the ink can be fed to the liner pen a single drop at a time, without flooding or spilling. To do this he removed the quill and drilled a hole through the hard-rubber stopper so that the quill could be reversed. It should be a snug fit and may be glued in place. To prevent evaporation of the ink, a rubber stopper, such as a small pencil eraser, or a wooden plug, is inserted in the open end of the quill.

—Ellsworth Davis, Geneva, Ohio.

Altered Drills Cut Smooth Holes in Thin Sheet Metal

By simply changing the angle of the cutting edges of old drill bits, one mechanic found that he could cut clean, round holes in thin sheet metal. The trick in re-grind-

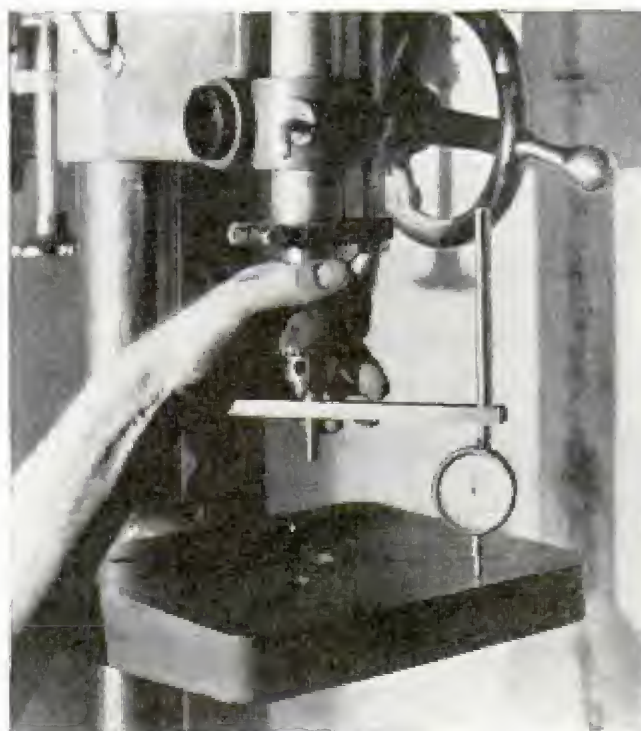


ing the drill is to produce a tapering center point with square sharp corners, the point being exactly on the axis of the drill. This point acts as a pilot in the same way as the small pilot drill on a hole saw, preventing the bit from running off-center and enlarging the hole. Holding the drill on the corner of the grinding wheel at the angles indicated produces both the center point and the cutting edges required. Check the accuracy of the grinding by measuring from the center point to the cutting edge on both sides.

—A. W. Hansen, Maywood, Ill

Testing Your Drill-Press Table for Precision Work

Use of a dial indicator will show up any inaccuracy of a drill-press table when preparing for precision work. A short piece of cold-rolled steel is drilled to receive an ordinary lathe mandrel on one end and the dial indicator shaft on the other. Insert the mandrel in the drill chuck and bring



the spindle down till the indicator point touches the table. Then lock the spindle. Turn the indicator and chuck by hand slowly while watching the indicator hand. It is surprising how much spring there is to a sturdy drill-press table. For this reason the table should be one or two thousandths of an inch high at the front

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NOVELTY FINISHES

with Brush and Spray

Crackle, crystal, spatter and veiled finishes, as well as wrinkling, shading, smutting and many others applied to furniture and novelties

NOVELTY finishes of interesting textures and color combinations can be used to advantage in the home or professional shop. They are smart and distinctive, cost little if any more to apply than the usual smooth finish of one color, and can be applied readily without previous experience. Most of the effects require a spray gun for successful application, although some can be brushed or dipped.

Crackle: Crackle enamel is available either clear or in standard colors, and is applied over a lacquer undercoat.

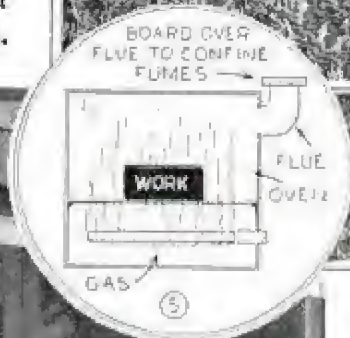


It dries almost instantly and cannot hold its original overall coverage, but instead cracks into numerous small sections, as can be seen in

Figs. 1 and 2. Red crackle over black lacquer is commonly used to produce a Spanish vargueno or oriental effect. Other good combinations are brown over ivory, green over gold and blue over gray. After the under coat has dried, the crackle coat is sprayed on. The lighter this is applied, the smaller

the cracks will be. Some experience is required in order to get a uniform surface. For pleasing, transparent effects on polished metal, colored glass, or parchment mix clear crackle enamel, about 10 parts, to the desired color, 1 part. The base coat should be clear lacquer or a rich, yellow gold. In all cases, the crackle coat should be protected, when dry, with a coat of clear lacquer.

Wrinkling: One of the most popular finishes on all kinds of metal work is wrin-





ling. The lacquer used is somewhat heavier than the average spraying lacquer. It is also sprayed, being applied best with pressure feed. Like most texture finishes, a thick coat gives a heavy, pronounced pattern, while a thin coat gives a fine-textured effect. A medium heavy coat works best. After spraying, the work is placed in an oven to bake. The temperature should be between 180 and 220 degrees Fahr. Fig. 3 shows the appearance of the wrinkling lacquer coat after baking. The baking time runs about 2 hrs. at 220 degrees.

Crystal: Crystal or crystallizing lacquer is another baked-on finish. It comes in black and clear only. The general effect

can be seen in Fig. 4, and consists of very small crystals. A light coat gives best results. Like wrinkling lacquer it is sprayed direct without undercoats of any kind. In baking crystallizing lacquer, it is necessary to confine the products of combustion inside the oven, as shown in Fig. 5. Baking time is about 30 minutes at 150° Fahr., Fig. 6.

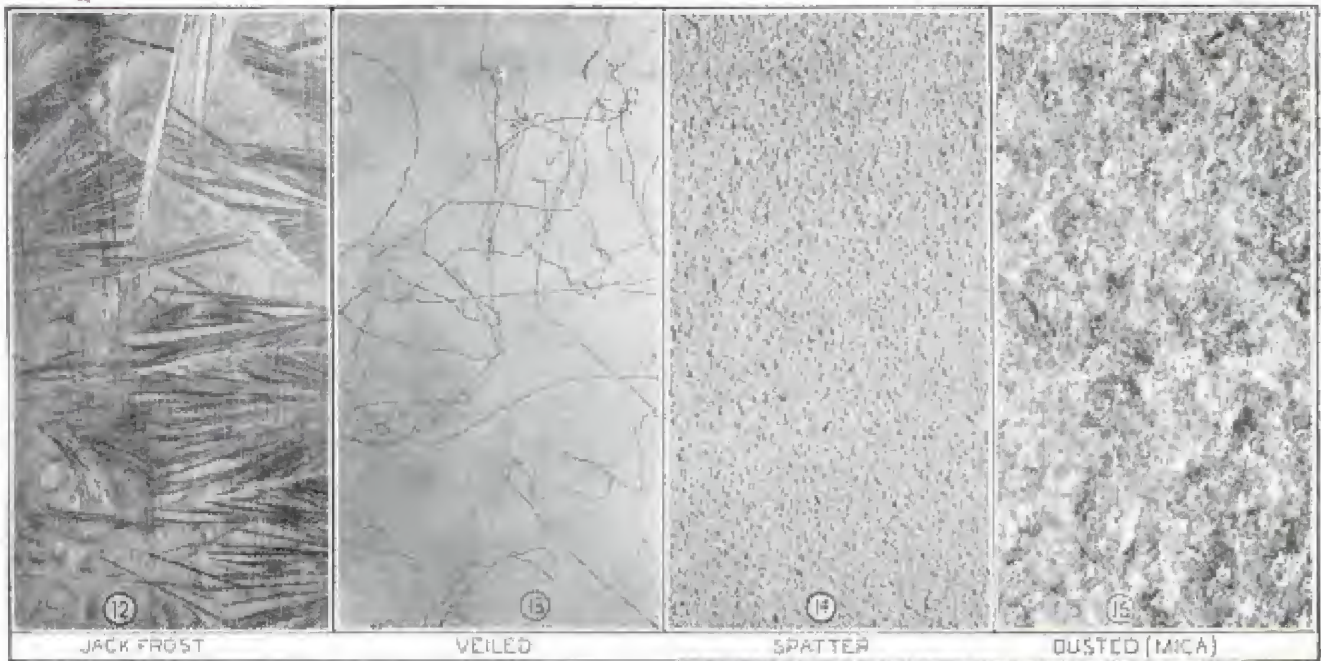
Shading: Shading or two-toning offers one of the simplest methods of securing a novelty effect on small furniture pieces, kitchen sets and the like. It is done by first applying a base coat, and then shading various parts of the work with a gun, as shown in Fig. 7. In a natural finish with clear lacquer, a special brown shading lacquer is used to secure the desired effect. Color shading can be done with lacquer enamels or with paste pigments ground in japan. The fluid should be of very light body so that it can be applied in a fine mist coat. Effective color combinations include black on light green or red, gold on black, tan on ivory, green on natural light wood, dark blue on light blue, etc.

Jack Frost: "Jack-Frost" lacquers come in all colors, both opaque and transparent. The fluid is applied directly to bare wood, metal or glass. A fairly heavy coat works best. The texture starts forming about 2 min. after application and appears somewhat as shown in Fig. 12 although the exact pattern may vary considerably. The transparent finishes are especially effective on polished metals, glass



COAT WITH BLACK OR OTHER COLOR PAINT; THEN WIPE OFF WITH A CLEAN CLOTH

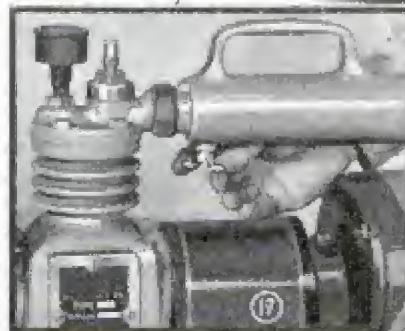




bottles, Fig. 8, light bulbs and lighting fixtures.

Side Shading: An interesting effect on any raised finish is applied by spraying a contrasting color with the gun held almost parallel to the surface, as shown in Fig. 9. The job being worked in this picture is a wrinkle finish in bright green. The top color being applied is red, and, because of the position of the gun, the red color is deposited only on the sides of the wrinkles. The finished job appears green when viewed from one side and red when viewed from the opposite side.

Smutting: To add color and depth, smutting is commonly employed. A typical example is shown in Figs. 10 and 11. The project being finished is a cigarette box, which has been coated





Many interesting effects in wall treatment are possible with the use of plastic paint

with red Jack-Frost lacquer. After this has dried, a smut is made by mixing paste pigments with japan or oil. Ordinary paint or enamel also can be used. A coat of the smutting color is applied, as shown in Fig. 10, and then immediately wiped off with a clean rag, as in Fig. 11, leaving the smut color in the depressed portions of the design.

Spatter: The familiar spatter effect is easily obtained by loading a large brush with the desired color and then striking it sharply against the hand to spatter the drops of color, as shown in Figs. 14 and 16. Similar effects can be obtained with a spray gun. For best results with a spray gun, pressure feed should be used. The paint should be of fairly heavy body, and the air pressure should be reduced greatly. On small spraying outfits, the reduction in pressure can be made by releasing the valve on the expansion chamber, as in Fig. 17. Contrasting color effects should be used on small areas, never for walls or other large surfaces.



Oxidizing: Imitation oxidizing, extensively used on metal products, is done by spraying black lacquer on polished metal, as shown in Fig. 18. A round spray pattern is required. Novelty effects using bronze powders mixed with bronzing liquid or clear or colored lacquers can be obtained easily. Where bronze powders are mixed with colored lacquers to secure a metallic effect, the proportions should be about one tablespoonful of powder to a pint of lacquer.

Dusting: In this process, the work is first coated with varnish. After the varnish has dried to a "tacky" stage, the top coating of bronze powder, pulverized felt, colored ground glass, etc., is sifted or dusted on. Figs. 15 and 19 show mica crystals being applied in this manner. Finish with a top coat of clear varnish.

Veiling: Giving the appearance of a string of color looped again and again on the surface of the work, veiling lacquers give an interesting effect, as shown in Fig. 13. Professional application requires a spe-



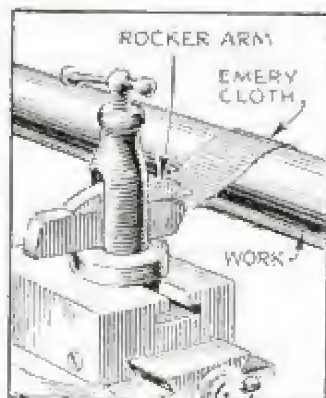
cial spray-gun nozzle, but a good novelty effect similar to spatter but with comet-like tails can be obtained by using this material in an ordinary spray gun.

Plastics: Plastic paint is commonly used for wall surfaces, but can be applied to flower boxes, vases and other products where a rough texture is desired. It is of heavy body, and is best applied with a brush. After it has set up slightly, the material can be worked in a number of different ways to secure the desired texture. One method commonly employed is to use a wooden float, pressing this into the finish and then pulling straight out, as shown in Fig. 20. Other textures can be obtained with a stiff brush, crumpled newspapers or with a towel.

Spread-Spatter: An effective variation of spatter work is obtained by using plastic or other paint. This is spattered in the usual manner and when slightly set up is brushed lightly, as shown in Fig. 21. The example shows a two-tone spatter effect of light red and green over cream, the two colors being spread at right angles.

Caen-Stone: As shown in Figs. 22 and 23, Caen-stone effect is a popular wall finish secured by using plastic paint. It is applied over a smooth base coat. The top coat of the same or a contrasting color is applied by knifing the plastic in place, then leveling it smooth with a trowel. Two-tone effects in this and other troweled finishes can be obtained by applying the color coat of pigment with a rubber roller.

Emery Cloth Gripp'd in Tool Post to Polish Lathe Work

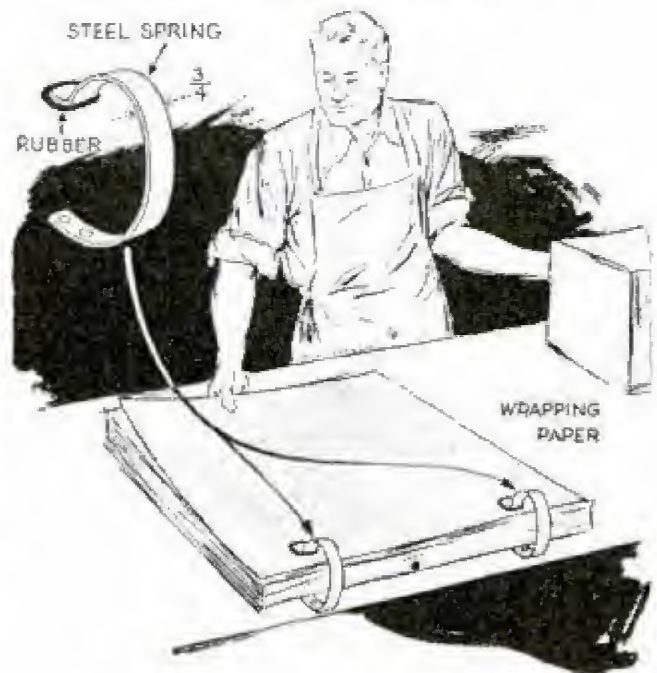


There's no need for tired fingers occasioned by holding a strip of emery cloth on metal-turning work, when polishing it, as the job can be done just as efficiently in most cases by using the tool post.

The end of the strip is inserted and tightened to the desired degree by the fine adjustment knob on the carriage.

—Don Heller, Pasadena, Calif.

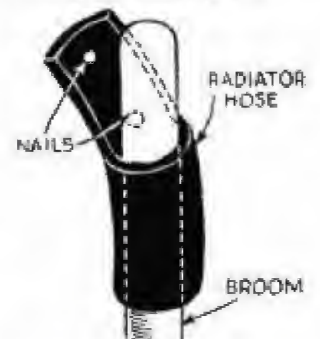
Springs Grip Wrapping Paper on Shipper's Table



Stacks of wrapping paper are kept in orderly arrangement by the moderate pressure of two spring clips, which are screwed to the table top. Whether a full stack or only a few sheets, the pressure applied is always practically the same. If you can't find suitable springs for this purpose, they can be made from $\frac{3}{4}$ -in. spring steel of a gauge to obtain the desired pressure. Pieces of sheet rubber are cemented to the tips of the springs as shown or sections of rubber tubing may be forced over the ends.

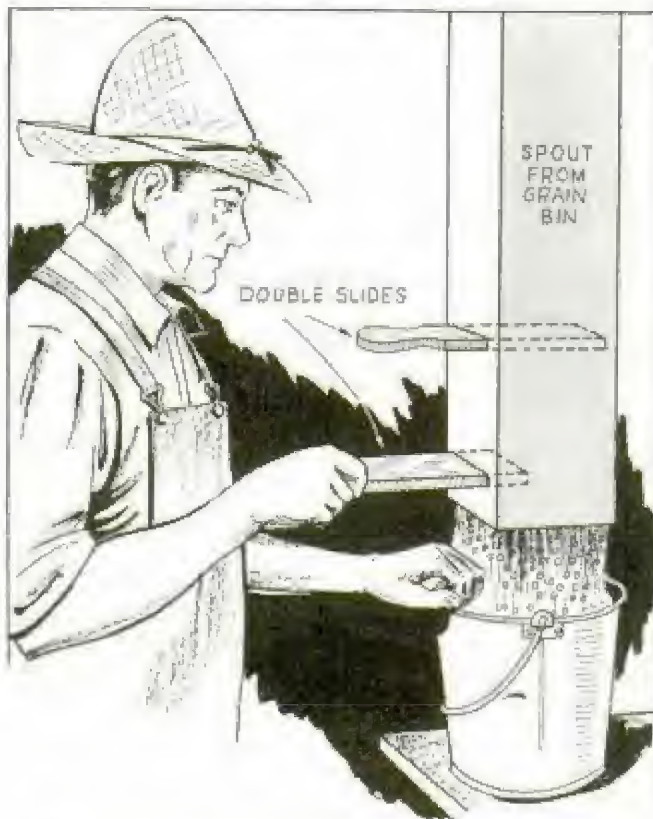
Shop Broom Held in Hose

A serviceable holder for your shop broom can be made by cutting a section of discarded radiator hose as shown and tacking it to a wall at an angle. When the broom handle is inserted and lowered to a vertical position, the twisted hose section grips it at opposite sides and holds it securely.



❑ When you are in a hurry to defrost a mechanical refrigerator, turn it off, empty the ice-cube trays, fill with boiling water and replace them in the freezing unit.

Double Slide in Grain Spout Measures Feed



To measure out a peck of grain each time, without wasting it by overflowing the feed pail, one farmer employs a double slide on the spout that leads from the grain bin. In use, the bottom slide is closed and the upper one is opened. Then the upper slide is closed and the lower opened to allow the grain to flow into the receptacle.

Tamper-Proof Air Vent



Allowing for expansion and contraction of gas and liquid in a storage tank, this tamper-proof vent with storm shield was made from a short length of pipe which forms a cap over a smaller pipe providing about $\frac{1}{2}$ in. clearance all around. The top of the smaller pipe was slotted and

the four segments were bent in and then welded together. Bolts were turned through threaded holes in the lower end of

the cap so that their ends bear tightly against the smaller pipe to keep the cover centered and to prevent removal by youngsters. The smaller pipe was attached to a flange which was then fastened to bolts imbedded in the concrete tank top.

Eraser Holds Linotype Slugs in Galley

One printer keeps linotype slugs from falling when moved about in a galley by using large rubber erasers, which are cut partly through the center to fit over the edge of the galley, as indicated. The holder may be moved back and forth when inserting or removing part of the contents.



Handles to Carry Lengths of Pipe Reduce Finger Strain

When carrying lengths of pipe, iron rods and bars that are tiresome to grip with the hands, a pair of these plywood or hardwood handles will help. They are bored to take the work and a hand hole is cut as shown, the sharp edges of the latter being rounded with a file.



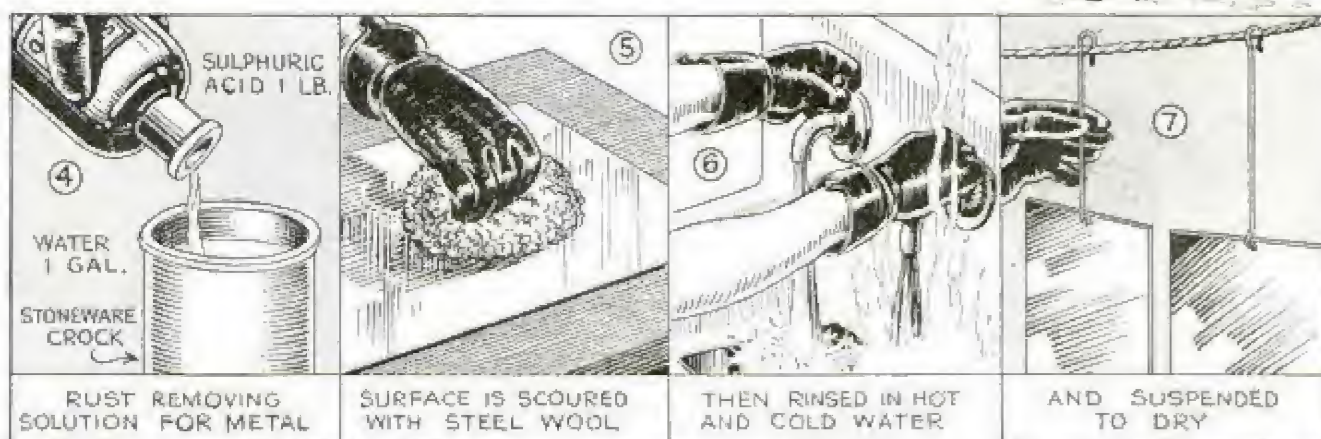
CEMENTING

glass, metal and celluloid

WHILE library paste is perfectly satisfactory for use on paper, no one would try to use it for a permanent joint on steel. Yet all of us have from time to time tried to use a cement which was no more fitted for the work in hand than library paste is for use on steel. Metal, glass and celluloid require special adhesives.

General Procedure: The first requisite for a strong joint is that the surface be free from dirt, dust, grease, rust and corrosion, Figs. 2 to 7 inclusive. The surfaces can be washed well and dipped in hot-lye solution to remove grease. Rust can be removed from iron or steel by repeated dipping in a solution made by pouring slowly sulphuric acid, 1 lb., in water, 1 gal., in a stoneware crock. As sulphuric acid will produce severe burns if gotten on the skin and will also damage cloth, it should be handled carefully, using rubber gloves. Between dips the surface should be scoured well with steel wool. The work should be rinsed well in hot and then in cold running water, and dried carefully. The edges to be joined should not be touched again with the hands. Any old cement or glue should be removed by soaking, scraping, or with a suitable solvent. Materials such as aluminum, which cannot be dipped in strong alkali, may be freed from grease by washing with naphtha, carbon tetrachloride, or similar grease solvents.

The adhesive must be brought into intimate contact with the parts to be joined. It is gen-





erally a good idea to roughen the surface slightly, using sandpaper or other abrasive, as in Fig. 1. Metal surfaces can be etched lightly with dilute hydrochloric acid, applied with a wad of cotton, Fig. 8. This roughening gives the adhesive a chance to grip the surface firmly. Adhesion also can be improved by brushing the cement on to the surface, Fig. 9, or, if the surface is porous, the cement can be rubbed into the pores. In the case of cements which must be heated, it is helpful and usually necessary to heat the work to the same temperature as the cement.

When the cement has been applied, the joint should be pressed firmly together and

held in that position until thoroughly dry. All excess cement should be squeezed out of the joint, and the excess wiped off before it sets. Pressure is best applied with a screw clamp. Wood-jawed clamps are excellent for fragile materials. Flat pieces can be laid out and pressed beneath heavy weights. If a suitable clamp is not available, a heavy string or length of copper wire can be tied around the joint and twisted tight. The work in all cases should be left undisturbed until it has become completely hard. Cements which are melted become hard as soon as cool; those which contain alcohol or other volatile solvents dry in a few hours by the evaporation of solvent. On the other hand, cements which contain drying oils may take weeks to dry thoroughly.

Cements for celluloid and similar materials: Celluloid adhesives usually are solutions of nitrocellulose or celluloid in various solvents. Cellulose acetate is generally cemented with solutions of cellulose acetate. These are good general-purpose cements, as they are strong and waterproof. Practical formulas are the following, all percentages by weight: (1) Scrap film or other celluloid 20, acetone 80. (2) Celluloid 20, ethyl acetate 60, alcohol 20. (3) Celluloid 16, ethyl acetanilide 10, acetone 74. (4) Cellulose acetate 12, tricresyl phosphate 8, methyl (wood) alcohol 20, ethyl acetate 30, methyl acetate 30. To these may be added 10 or 15 per cent filler if desired. Cellulose acetate can be substituted for celluloid in these formulas, and vice versa. The celluloid or cellulose acetate should be cut fine, and if scrap photo film is used, the gelatin should be removed by scraping or by scouring with steel wool, as shown in Fig. 10. The solvents used are very volatile and inflammable, and the ce-

ments must be kept in tightly corked containers until needed.

Celluloid can be "welded" also without heat if the edges to be joined are softened with a mixture of alcohol, 3 parts, and ether, 4 parts, and pressed firmly together. These solvents are volatile and the vapor of ether is highly explosive; therefore, this solution should be used away from all flames and sparks, and where there is adequate ventilation.

Cellophane can be cemented with a mixture of gum arabic, 2 lbs. 3 oz., water, 3 qts. 9 oz., and glycerin, 3 lbs. 12 oz., to which $\frac{1}{8}$ oz. formaldehyde is added.

Cements for glass: A waterproof glue can be made by soaking ground glue, 10 oz., in sufficient water to bring it to the usual consistency, Fig. 11. Potassium dichromate, 2 oz., is dissolved in a little water and added to the glue. The glue mixture must be kept away from light. After the glue has been applied and the joint clamped, it is set in direct sunlight until thoroughly dried. This joint is completely waterproof after a thorough exposure to light.

An acidproof cement for glass and stoneware can be made by melting together equal parts of pitch, rosin, and plaster of paris, and applying the mixture while molten. Equal parts of gutta-percha and gum shellac melted together make a cement which is strong and waterproof. Casein mixed to a paste with a saturated solution of borax, or with waterglass, makes a strong cement.

Cements for metals: Metal surfaces can be cemented together, or metal can be cemented to stone with a cement made by mixing litharge and glycerin to a paste of suitable consistency. It must be mixed just before use as it sets rapidly. Addition of whiting, silica, or iron oxide will retard the setting time. Metal also can be cemented in stone or marble with a mixture of iron filings, 1 lb., and plaster of paris, 3 lbs., made into a paste with water.

Iron articles can be cemented with a mixture of iron filings and waterglass. Another cement for iron is made by mixing ammonium chloride, 1 lb., sulphur, $\frac{1}{2}$ lb., and iron filings, $\frac{3}{4}$ lb., and adding water just before using.

☛ Liquid wax applied to oilcloth will keep it from cracking and peeling.

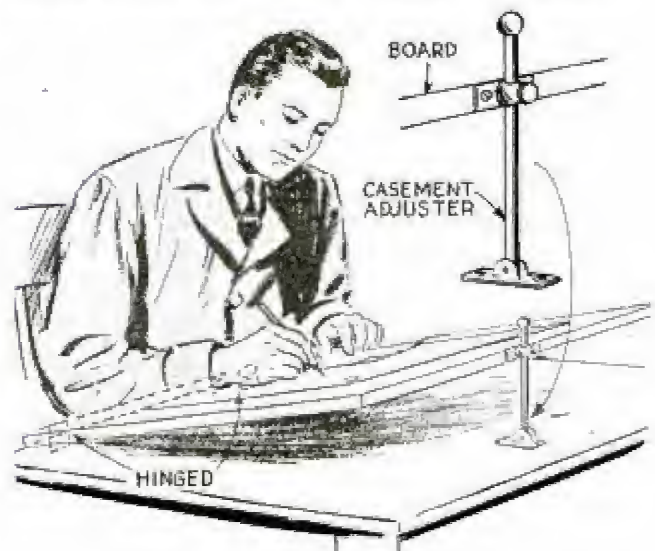
Door Knobs Serve as Pestle in Emergency



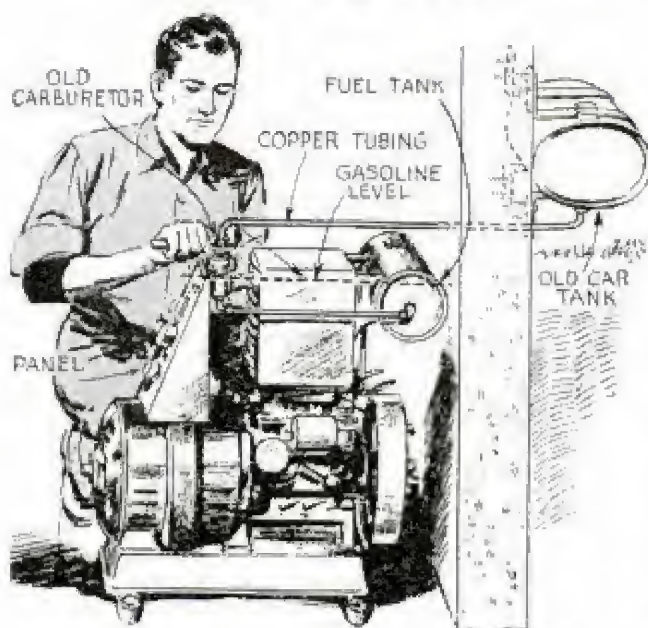
Amateur chemists who need a pestle for crushing crystals of various kinds, will find that a pair of discarded door knobs and a strong bowl serve the purpose. A little friction tape wrapped around the knob held in the hand will improve the grip.

Drawing Board Held at Angle with Casement Adjuster

If you use a drawing board on a desk or table, a convenient working angle can be maintained by using a casement adjuster of the type shown. Attached near the rear of both table and board, it provides an ideal arrangement for tilting the board.



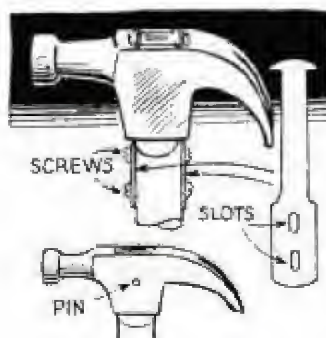
Installing a Large Fuel Tank on Your Light Plant



Instead of filling the small gas tank on your farm-lighting plant every couple of days, why not save time by installing a large auto gas tank, which needs only an occasional filling? Mount the large tank outside the building so that it is slightly above the small one. Then run small pipe or copper tubing to the inlet of an old car carburetor, mounted so that the bottom of the bowl is at the same level as that desired for the fuel in the small tank. Remove the drain cock from the bottom of the carburetor and run a pipe from it to the small tank. The carburetor float keeps the fuel level in the small tank constant.

—G. W. White, Severn Park, Ont., Can.

Anchoring Hammer Heads

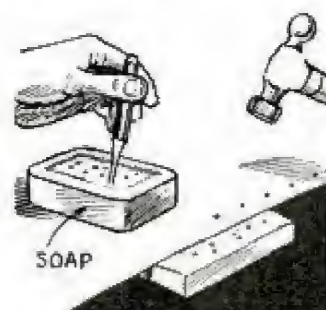


Where changing conditions of humidity allow heads on hammers to loosen, safety from danger of the head flying into space when least expected, is possible if you provide a couple of T-shaped anchors. These are cut from $\frac{1}{16}$ -in. metal and are passed through the hole in the head when it is driven on the handle so that the ends of the anchors can be screwed to the top and bottom of the handle. Slots are suggested instead of

holes in order to permit takeup. Another method of pinning the head to the handle is shown in the lower detail.

Soap Lubricant Speeds Punching of Sheet Metal

Annoyance of a metal punch sticking in the sheet metal when a number of holes are punched may be minimized by keeping a bar of soap at hand and pushing the point of the punch into the soap at frequent intervals. In this way sufficient lubrication is provided to ease withdrawing the punch.



Overhead Shafts Polished Easily with Long-Handled Tool

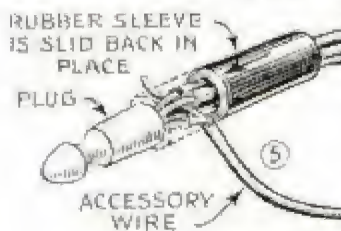
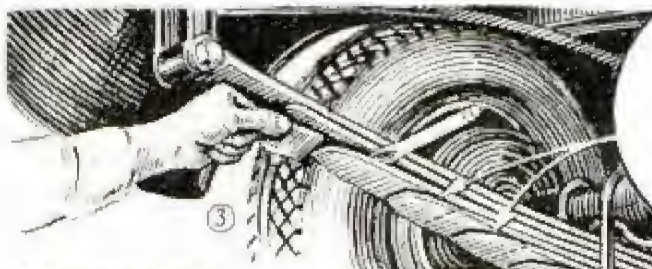
To clean and polish overhead shafting that had rusted while the plant was idle, one foreman used the tool shown. It consists of a split length of garden hose tacked to the end of a suitable pole. Emery powder, sprinkled in the rubber trough formed by the hose, facilitated the cleaning.



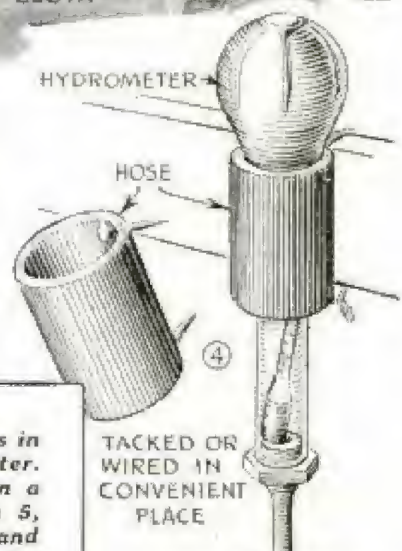
Helps for the MOTORIST



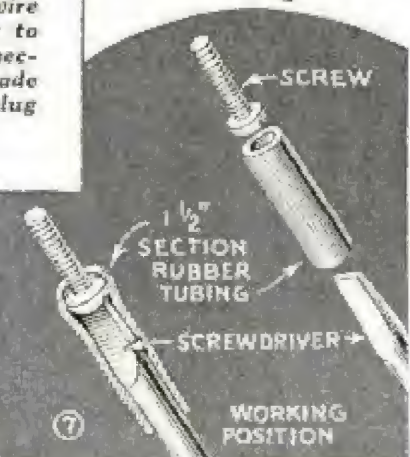
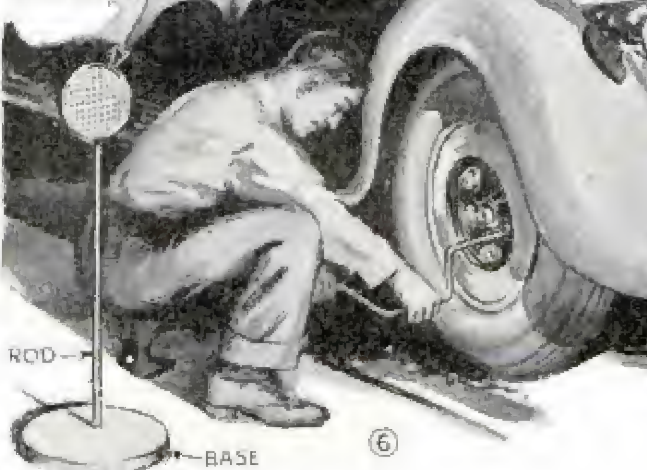
1: Heat developed by rubbing a door handle briskly with a cloth will often thaw a little ice in the keyhole. 2: Before inserting a bulb in a head or tail lamp, coat the base of the bulb with flake graphite so that it will not corrode and stick in the socket. 3: Some motorists claim that springs of older motor cars can be improved by inserting pieces of oiled rubber between the leaves at the ends



Piece of radiator hose fastened to a wall as in 4, provides a handy holder for a hydrometer. When connecting electrical accessories on a car that has plug-type connectors as in 5, slide back the insulating rubber sleeve and insert the bared end of the accessory wire between the wires of the plug. It's best to apply a little solder to make a good connection, although a temporary one can be made by moving the sleeve back against the plug to hold the wire in place

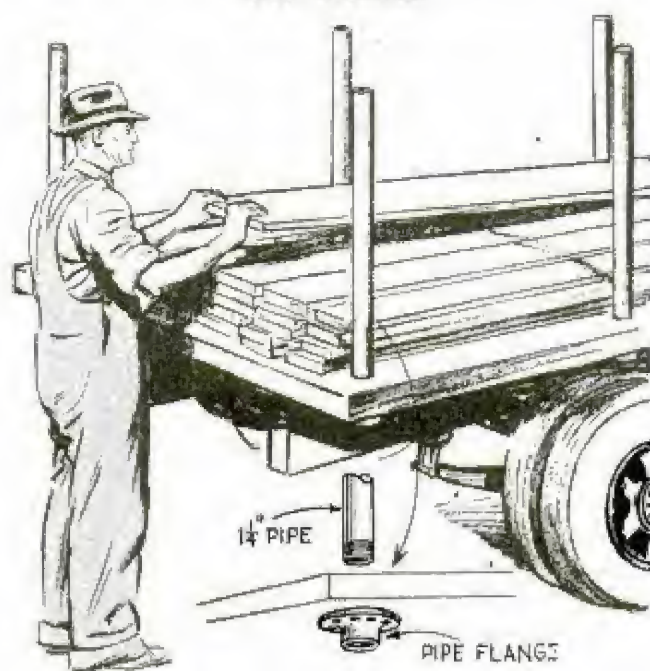


RED GLASS REFLECTOR



If a red reflector like the one in 6 is carried in your car, it may help avoid an accident when changing a tire at night. The reflector is soldered to a brass rod, which is stuck in a small wood disk to serve as a base. A piece of small rubber tubing slipped over the blade of a screwdriver as in 7, provides a good screw holder

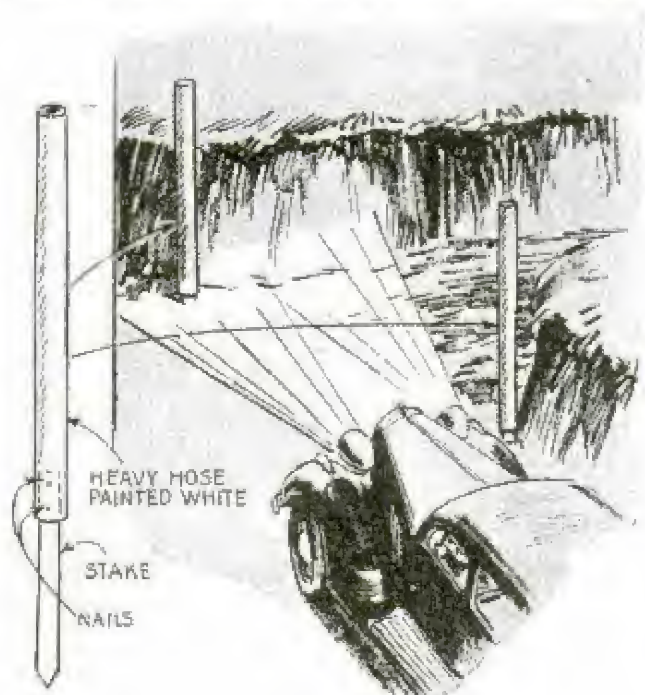
Floor Flanges Hold Pipe Stakes on Truck



Pipe stakes on a truck can be attached securely by means of floor flanges screwed to the underside of the floor, in line with the holes in which the stakes are to be inserted. This method permits quick insertion or removal of the stakes and there is little possibility of them becoming loosened accidentally and lost.

This Rubber Driveway Marker Does Not Break Off

As the driveway to one neighbor's house entered the highway at a sharp right angle,

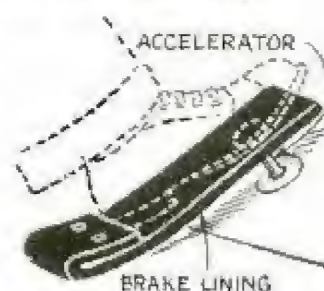


with high banks on each side, and wooden marking posts were repeatedly broken by motorists turning too short, lengths of stiff water hose were substituted. These were attached to wooden stakes extending 3 or 4 in. above the ground. The hose was painted white for visibility at night.

—James Vick, Winterpeck, Va.

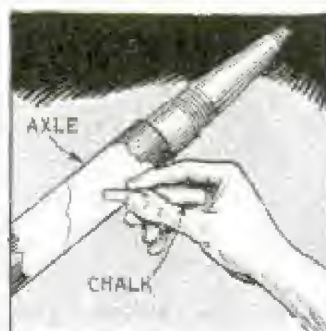
Improving Toe Accelerator

A mechanic, servicing a number of trucks which were provided with ordinary toe-type accelerators, learned that many of the drivers were complaining of foot strain on long trips. To



avoid this, he mounted pieces of heavy brake lining over the accelerator buttons to provide foot and heel rests.

Chalk Locates Crack in Axle

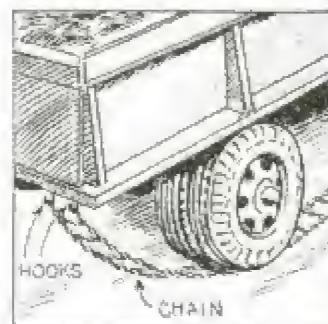


Axles or drive shafts of automobiles sometimes develop cracks that cannot be seen with the naked eye. If the shaft is cleaned thoroughly and given a coating of

chalk, oil or grease that remains in the crack will seep through the whitening to reveal the crack in a dark line.

Skid Chains Suspended from Body to Move Truck on Inclines

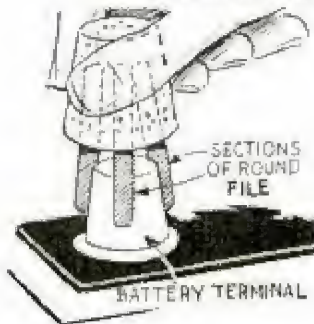
A rural truck driver who needed skid chains in bad weather at a few of his stops, which were on inclines, but did not need them elsewhere, solved the problem by fastening



the chains to the truck body behind each rear wheel. When a stop was made where

the chains were needed, the wheels were allowed to roll back on the chains, which afforded the traction necessary to start the load moving. Hooks were provided so that the chains could be removed readily.

Bottle Stopper and Files Clean Battery Posts



One garage mechanic improvised an effective tool for cleaning storage-battery posts quickly by inserting three pieces of a round file into holes drilled in a large rubber stopper.

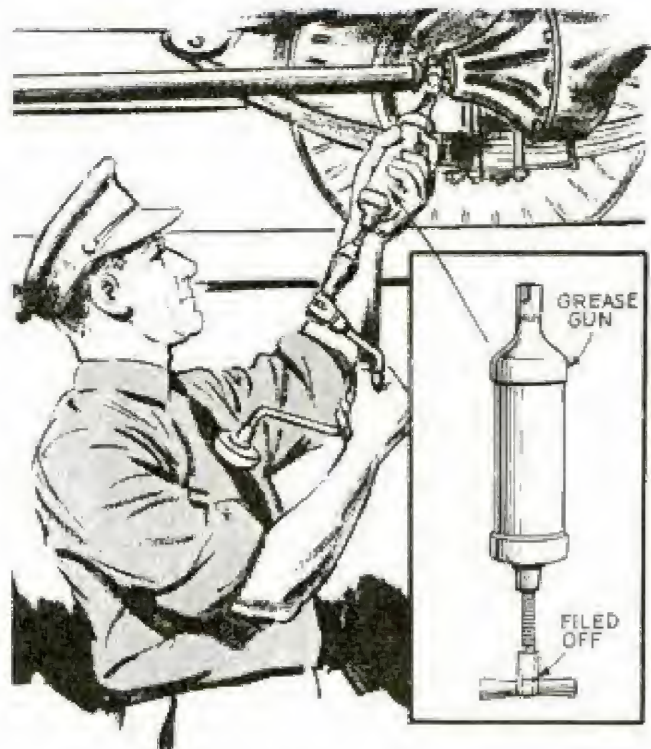
The files adjust themselves to fit any variation in diameters of the posts.

Flashlight Hangs on Rubber Cable to Inspect Batteries

Observing the danger involved in lighting matches when inspecting batteries on a charging line, one garageman strung a stout wire above the line and from this suspended a flashlight with a steel ring and rubber cable. This so simplified the use of the light for close examination of the batteries that the danger was completely eliminated.



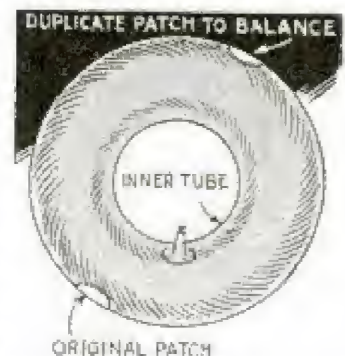
Grease Gun Is Turned by Brace to Loosen Clogged Bearings



Forcing grease into "frozen" fittings with a hand grease gun of the screw type can be accomplished usually with little effort if you use a carpenter's brace. To do this the handle of the grease gun must be cut off and the end of the shaft squared so that it will fit into the brace.

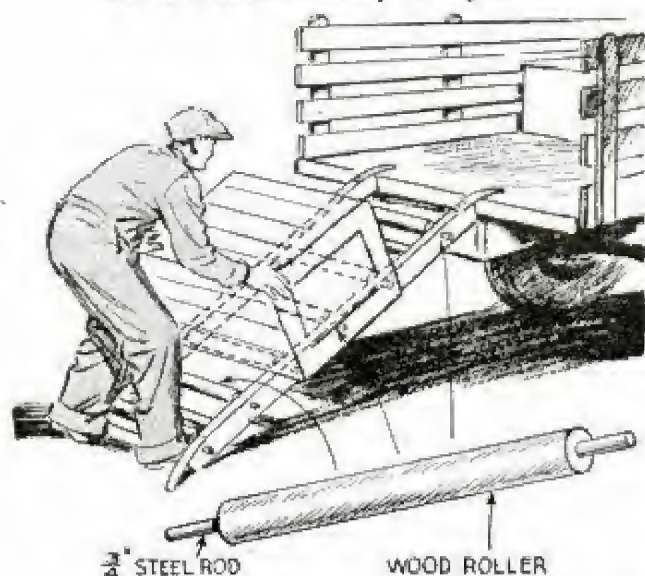
Duplicate Patch on Inner Tube Keeps Wheel Balanced

A Wisconsin garageman claims that steering troubles often can be traced to uneven balance of one of the front wheels, caused by a heavy patch on the inner tube. In such cases he balances the tube by placing a duplicate patch on the opposite side. The same care is even more essential in placing large repair boots in casings.



❑ A little vaseline placed in the joint between the rim and body of a headlamp will make it easier to remove the lens and also helps keep out water.

Rollers Fitted on Truck Skid to Load Heavy Objects



To push heavy boxes single-handed into a truck, one driver put removable rollers on his unloading skid. They are turned from hardwood to a diameter of 1 in. great-

er than the width of the side members of the skid. The rollers are drilled lengthwise for heavy steel rods, which are a sliding fit so they can be removed. Holes in the side members of the skid serve as bearings. When the skid is used for unloading, the rollers are removed.

Connecting-Rod Bolts Weakened by Excessive Tightening

While it is important that nuts on connecting-rod bearings be drawn up snugly to avoid looseness of the bearing caps, excessive tightening may stretch the bolts and weaken them appreciably. Or, the threads may be damaged so that strain on the bearings, when the motor is in operation, tends to loosen the nuts, making it necessary to install new bolts. In some cases, it may not be noticed that the threads or bolts are damaged, and the bearings tightened only to have them loosen again.

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Hundreds of useful and attractive things to make in your workshop

Profusely illustrated to show just what the articles listed look like when finished

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MODERN AND COLONIAL FURNITURE of all kinds such as tables, chairs, stands, magazine baskets, cupboards, cabinets, chests, sewing baskets, etc.

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POPULAR MECHANICS PLAN SERVICE, 200 E. Ontario St., Chicago, Illinois

EASTMAN'S NEW HIGH SPEED FILM

**MAKES NIGHT SNAPSHOTS
EASY EVEN FOR A \$1 BROWNIE**



ONCE it took an expert—and an expensive camera—to make snapshots at night. Now the most inexperienced of picture takers are shooting happily away after dark. You need less light indoors than ever before; and you use any camera that takes the new high speed film, Kodak Super-XX—even an inexpensive Brownie. And what pictures you get! Taken instantaneously, with a film four times as fast as ordinary film, they're unposed, informal, full of life.

FREE BOOKLET. . . This little booklet introduces you to one of picture taking's biggest thrills—snapshots at night. A single reading, and you're ready to make nighttime snapshots you'll be proud of. Non-technical text, interesting photographs, easy-to-understand diagrams, and light arrangements. At your dealer's . . . Eastman Kodak Company, Rochester, N.Y.

ALL YOU NEED

1. Your present camera loaded with the new Kodak Super-XX Film
2. A couple of inexpensive Mazda Photoflood lamps in Kodak Handy Reflectors



Hotels on the Wing

(Continued from page 405)

overstuffed chair, while the rearmost station is the flight engineer's quarters, with desk and expansive instrument and control panels. The engineer handles fuel valves, mixture controls, temperature controls, propeller adjustment controls and engine synchronization.

Second of the new air giants is the Douglas "DC-4," largest commercial land plane in the world. Truly a hotel on wings with accommodations for forty-two guests by day or thirty by night, it has a top speed of four miles per minute. A crew of five operates the huge ship.

Its steam-heating system automatically maintains a temperature of seventy degrees inside the cabin. Air, individually regulated by each passenger, is forced into the cabin at the rate of 1,250 cubic feet per minute. Two auxiliary engines, working independently of four giant motors generating a total of 5,600 horsepower, supply electricity to light the ship, cook food or operate hair curlers and electric shavers.

The "DC-4" has a comfortable ladies' lounge and men's dressing room and even a private compartment which may be used as a bridal suite. There are telephones for the crew and a dictaphone for businessmen who want to work while traveling.

The "DC-4" was built to the order of United Air Lines, Transcontinental and Western Air, American Airlines, Pan-American Airways and Eastern Air Lines. All production models will have supercharged cabins for substratosphere travel. This ship has a "tricycle" landing gear, which incorporates a nose wheel to permit shorter and safer take-offs and landings and prevent nosing over if brakes are applied suddenly or the wheels strike an obstruction. The gear is ideal for "blind landings."

"Upper level" flying becomes more than a dream with introduction of another Boeing ship, known as the "Stratoliner." This craft is designed to carry thirty-three passengers by day or twenty-five in luxurious night accommodations at speeds above four miles per minute through the smooth, rarefied atmosphere found at 14,000 to 20,000 feet.

The "Stratoliner's" path lies below the true stratosphere but above the heavy air belt that brews surface weather conditions.

At 20,000 feet winds are considerably more constant than at normal flight levels and the air is virtually free from the turbulence that sometimes gives airplanes a "rough ride" on lower levels. Storm clouds and icing conditions, both flying hazards, usually lie below this flight belt. And the air is so rarefied that high speeds at normal cruising power are practical.

While the "Stratoliner" is propelled by four engines, each providing 1,100 horsepower for take-off, only 2,500 horsepower is necessary to drive it 240 miles per hour at 20,000 feet. So great is the amount of reserve power, complete loss of power of one engine during take-off creates no danger. In fact, any two of the four engines can maintain an altitude of 10,000 feet and speeds up to 170 miles per hour, with the air liner fully loaded.

Natural low-level atmospheric conditions for "upper level" passengers are created by automatic temperature and pressure-regulating devices within the sealed cabin. The pressure controls make it possible to bring the ship from 15,000 feet to sea level at 565 feet per minute without discomfort to passengers.

Fresh air, drawn through the leading edge of each wing, is compressed by two engine-driven superchargers and circulated through the cabin after being heated by freeze-proof steam radiators, and then is discharged through an exhaust chamber.

The right-hand side of the passenger cabin is divided into four compartments, each containing davenport-type seats for six passengers. Along the left side are nine reclining chairs. At night, each compartment makes up into two sets of upper and lower berths, each of which is six feet seven inches long. Windows, fresh-air inlets, reading lights and call buttons are placed in both upper and lower berths. The ship also offers the conveniences of women's and men's dressing rooms with every facility for the toilet. A galley permits the serving of hot meals in flight.

In addition to hotel-like comfort and luxury, each of the super-airliners offers one or more of these new safety features: Four-engine power, pressure cabins for high flying, inclusion of flight engineer in the crew to relieve pilots of engineer duties, and the tricycle landing gear.



*that old
Velvet flavor
sure keeps
a pipe
in tune*

Velvet

- the **MILDNESS**
of fine old
Kentucky Burley
aged in wood
- the **FLAVOR**
of pure maple
sugar for extra
good taste

*Velvet packs easy in a pipe
Rolls smooth in a cigarette
Better tobacco
for both*

*Better
smoking
tobacco*

Racing the Mighty Midgets

(Continued from page 388)

secret blends consisting of a white gasoline base to which lead and benzol are added in varying amounts, or else some high octane aviation fuel that is made even more anti-

weather conditions. As many as twenty or twenty-five different gear combinations may be carried by a shrewd driver and he can change gears in a few minutes between races through a plate in the rear end.

Rules of the American Midget Association restrict the engines to 105-cubic-inch displacement, or sixty-five cubic inches with a supercharger. The cars must weigh between 550 and 950 pounds dry, most drivers finding that a car weighing between 700 and 750 pounds seems to handle easiest. Above that weight a car is sluggish while below 700 pounds the great power in the rear end tends to jump the car off the ground if it happens to hit a hole. A few drivers are now trying out front-wheel and four-wheel drives.

Outboard marine engines, re-built automobile engines, and various built-up engines were used when midget racing got its start and many of them are still in use today. Most of the consistent winning drivers, however, are using a special racing motor that costs more than \$1,000. This Offenhauser engine is a four-cylinder double overhead valve motor that develops 100 horsepower at 6,500 revolutions per minute.

Prizes at the best tracks range from \$1,500 to \$2,500 per night of racing with the

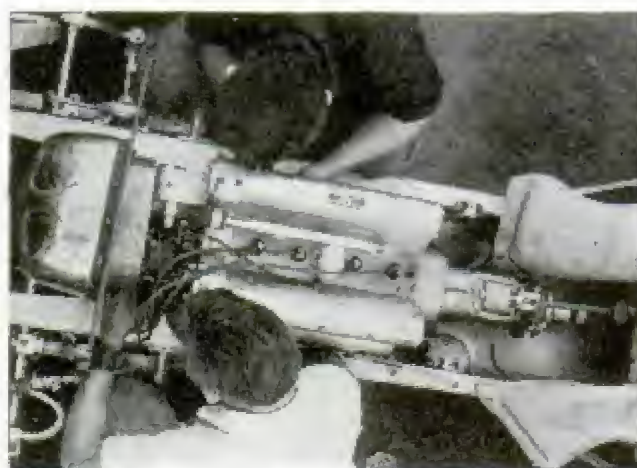


Inner tube protects driver's throttle foot in car that has developed an oil leak

knock by additions of lead compound. Some drivers use one carburetor per cylinder although one driver, for some reason he can't explain, seems to get the best results out of his four-cylinder engine by using three carburetors.

Most midget tracks are banked dirt tracks with a surface of clay and decomposed granite, packed down and sprinkled before each race program. The condition of the surface and the changes made in it by the pounding cars have their effect on speed, and a good driver carries several sets of tires to use at different times. Grooved tires are usually mounted in front for good steering, knobbed tires in the rear when the track is slick, smooth rear tires when the track is heavy, and rear tires with some standard tread when the track is in just the proper intermediate condition for fast driving.

Likewise a good driver changes his rear end gear ratio according to the track and



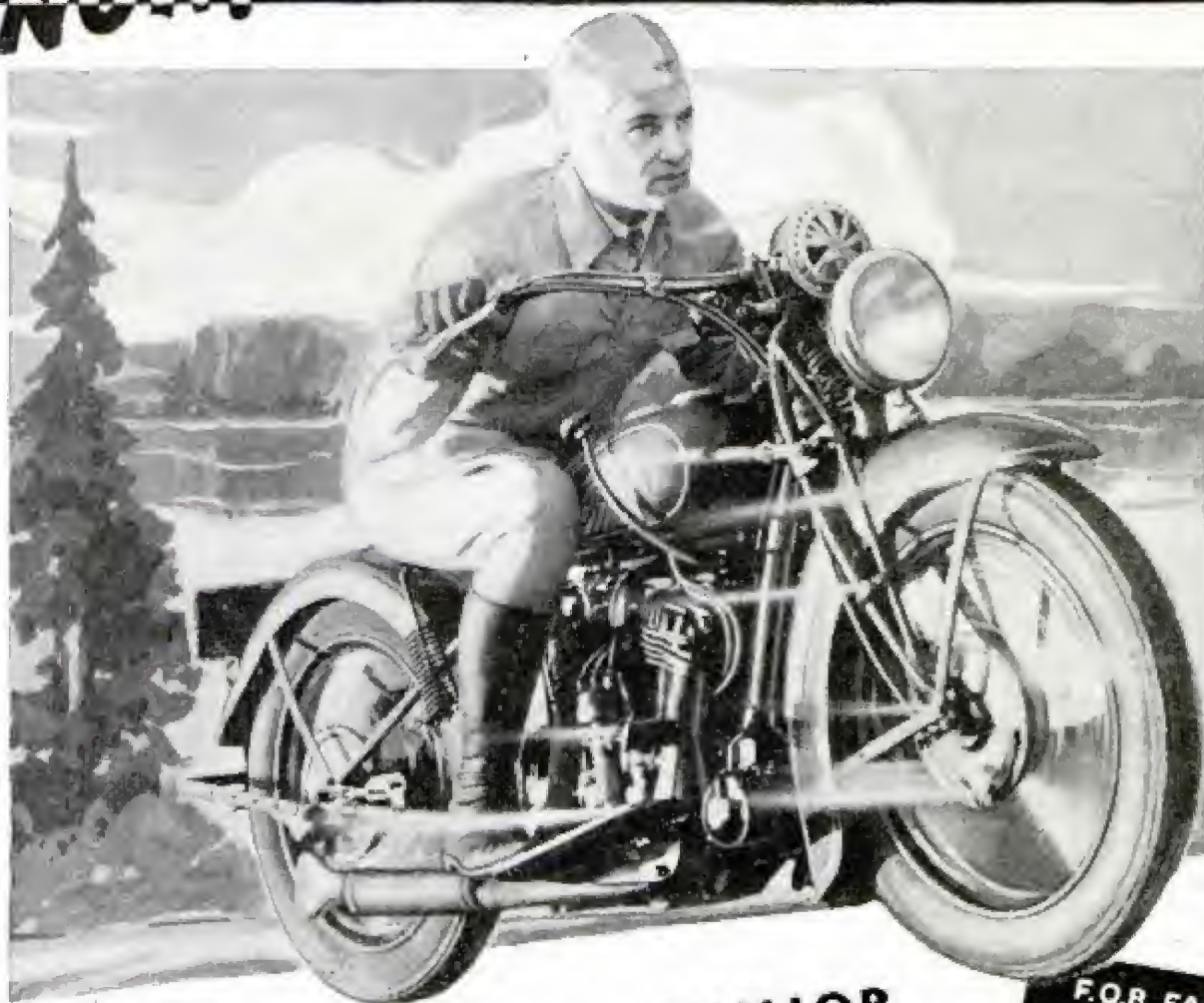
Putting finishing touches on tiny engine that develops up to 100 horsepower

purse being split up among the winners of several races. An important midget track such as the Gilmore Stadium at Los Angeles, holding thirty-two race meets during a season, may attract a total attendance of half a million people during that time.

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[] 16-19 yrs. [] 20-30 yrs. [] 31 yrs. and up [] under 16 yrs.

INDIAN MOTORCYCLE CO., Springfield, Mass.

Going Nature One Better

(Continued from page 373)

deners were planting rows of the double yellow nasturtium seed, purchased from the Bodgers, alongside rows of the old-fashioned single nasturtiums in all colors. When the plants blossomed, a hundred girls with camel's-hair brushes went down the rows, tickling first a single, then a double flower. Thus by hand pollination, they crossed the doubleness and the sweet odor of the new type with the multi-colors of the singles. It was a tremendous undertaking but they made 40,000 crosses that summer.

Other seed growers were doing the same thing, but on a smaller scale. Ordinarily, it is a three to five year job to cross two varieties, creating a new type by relentlessly weeding out the off-plants, then growing enough seed to supply the market. That fall, when other growers gathered their seed of the first generation crosses, and stored it in moisture-proof warehouses to await spring, the Burpees proceeded in a most unorthodox manner. They packed their double nasturtiums in airy boxes, even before the seed was dry, and shipped it by air to South America, Cuba, and Florida. Other packages went to Australia. Some they planted at Chula Vista near San Diego. The Burpee greenhouses at Fordhook were cleared of all other flowers and planted to nasturtiums. There the plants thrived under artificial light and steam heat.

By midwinter, the Burpees had "rogued" out all the plants bearing double flowers, much to the consternation of their gardeners. However, David Burpee anticipated that the nasturtiums were recessive in the second and third generations. Those that were double in the second would produce singles in the third. Those that were single in the second would become double in the third. By early spring, Mr. Burpee had accumulated more than 100,000 seeds which he could count upon safely to produce doubles in a variety of colors, and so great was the demand at ten cents per seed that he had to grow quantities of plants from cuttings.

This discovery that three generations of a new plant in the making could be kaleidoscoped into one year is one of the most revolutionary innovations in outwitting

nature developed in the past decade. The Burpee hybridizers maintain a winter farm regularly at Chula Vista, and not only nasturtiums, but petunias, marigolds, zinnias and other flowers have been given the speed-up in the modeling process. Other breeders have followed suit. Just as designers in other fields have their ideas of what the public wants, so flower builders have to guess from three to five years ahead and create not only the right color or the right flower, but also build up a sufficient stock of seed to supply the demand.

One of the most revered flower originators is Frank Cuthbertson, executive of the Ferry-Morse company. Mr. Cuthbertson is a builder of vegetables as well as flowers, but his fame comes mainly from what he calls his "sweet pea workshop." It is a two-acre garden at Salinas, Calif., where he has undertaken to remodel the sweet pea, which has been driven from southern, midwestern and eastern gardens by the hot summers. The sweet pea, as developed for gardens of a quarter of a century ago, just couldn't take heat.

Like other plant breeders, Mr. Cuthbertson needed a mutation to start. He scoured the world for one and even sent to Sicily, where the first sweet pea, a scrawny but hardy plant with a little purplish flower, was discovered two centuries ago, and started again at scratch with this same rugged forebear. While he was working, Dame Nature, in a generous mood, handed him a gift, a sport with foliage twice as sturdy and luxuriant as any other plant in his garden. It bore huge pink blossoms and soon became known as "Pinkie." It was most astonishing for this to happen right in his sweet pea workshop, because seed hunters had scoured the world, looking in vain for this very phenomenon. Mr. Cuthbertson knew he had something. In succeeding years, he crossed the giant with sweet peas of every other color, and once more, as the result of "Pinkie blood" in their veins, sweet peas are returning to the gardens of regions with hot summers.

The elder W. Atlee Burpee, credited with having introduced more new flowers and vegetables into the gardens of this country than any other individual, used to travel

(Continued to page 120A)

NO SKINNY MAN HAS AN OUNCE OF SEX APPEAL

BUT SCIENCE HAS PROVED THAT THOUSANDS DON'T HAVE TO BE **SKINNY**

Portrait by professional models



THOUSANDS OF THIN, TIRED, NERVOUS PEOPLE GAIN 10 TO 25 LBS. . . NEW STRENGTH QUICK

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Gains 14 lbs. Popular Now



Don Russo

"I had lost weight, had no pep, looked so bad I was ashamed to go out. With Ironized Yeast in 3 months I gained 14 lbs. My new huskiness and pep has brought me lots of new friends, too."

Don Russo, Phila., Pa.

Admired Since He Gained 12 lbs.

"Was losing weight and pep. Nothing helped until I got Ironized Yeast. In 6 weeks I gained 12 lbs. and am full of pep. Everybody admires my physique, too."

Ralph Loeffler
Arlington, Wash.



R. Loeffler

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Beware of Substitutes



THOUSANDS of skinny, rundown people who never could gain before have quickly put on pounds of solid, naturally attractive flesh, with these remarkable scientifically tested little Ironized Yeast tablets. What's more, instead of that terrible tired feeling and jittery nerves, they now have wonderful new strength and energy, eat well, sleep soundly and with improved looks and new pep have won new friends and popularity.

Why they build up quick

You see, scientists have discovered that many people are underweight and rundown, often tired and nervous, simply because they don't get enough Vitamin B and iron from their daily food. Without these vital substances you may lack appetite and not get the real body-building good out of what you eat.

Now you get these exact missing substances in these amazing little Ironized Yeast tablets. The improvement they bring in a short time to those who need Vitamin B and iron is often astonishing. Thousands report gains of 10 to 25 lbs., wonderful new pep—a new natural attractiveness that wins friends everywhere.

Try them without risking a cent

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Only be sure you get the genuine Ironized Yeast, and not one of the cheap, inferior substitutes often offered which do not give the same results. Look for the letters "IY" stamped on each tablet. You don't want inferior substitutes.

Special offer!

To start thousands building up their health right away, we make this special offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with the first package—or money refunded. At all druggists, Ironized Yeast Co., Inc., Dept. 533, Atlanta, Ga.

TUNE IN ON THE GOOD WILL HOUR, every Sunday Evening. See your local paper for time and station.

H1250

(Continued from page 118A)



Saws of Craftsmanship

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6" (1/2" hole) \$4.30 8" (1/2", 5/8", 3/4" hole) \$5.40
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30,000 miles each year, scouting for bigger, better varieties. He sought better plants ready made, the "pick-up" method of improving strains.

Today, the seed hunter scarcely hopes to find a new plant in perfect condition. He is looking for traits. A few years ago a federal seed hunter scouting in the interior of India discovered a tough and unattractive little musk melon, practically unedible, but able to resist a blight which had suddenly descended upon the great winter gardens of this country. The resistance of this insignificant India melon, bred into American varieties, soon produced a new strain which revived a waning industry.

Uncle Sam's seed hunters are now rounding up vegetables with useful characteristics from every land and acclimating them on half a dozen farms operated by the Department of Agriculture. They also furnish breeding stocks to experimental farms operated by the agricultural colleges of the states. With this start, scientists are inducing nature to create tomatoes that ripen in the short northern summers, corn that flourishes despite the cool nights of the Pacific coast and a host of other useful garden products.

The evolution of hybrid corn is an outstanding example of outwitting nature. Sweet corn has suffered from blights, and in several experimental stations, the hybridizers tried inbreeding to make the stock more true. Several generations of inbreeding invariably resulted in plants of smaller stature, as might be expected, but to the amazement of scientists doing the work at the Connecticut experiment station and at Purdue university, the resulting progeny when these pigmy strains were crossed turned out to be giants. Today, virtually all sweet corn grown in the country is "corn that went to college," one or another of the hybrid strains produced by planting two inbred varieties side by side and de-tasseling the female parent.

A hybrid plant, combining the best characteristics of two parents, is just making its appearance among flowers. It is the new red marigold, developed by the Burpee hybridizers. It combines the velvety red color of the little French marigold with the luxuriant round head of the big African. Combining these was a feat, because the little French male parent has more chro-

141250

mosomes than the big African female parent. This unequal balance has defied the efforts of hybridizers for years, and even now the resulting hybrid is sterile. As a consequence, if red marigolds are to exist, the plant builders must hybridize them to order each year for next summer's gardens. The marigolds can't reproduce themselves by natural means.

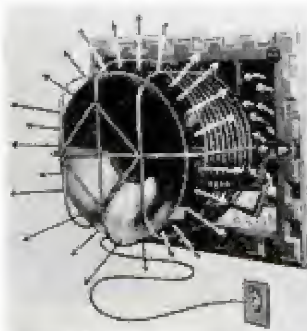
However, science has one more trick to play. Plant builders have discovered that when nature spurns their efforts at crosses because one parent has more chromosomes than the other, by certain "shock" treatments, they can change the chromosome balance. One method is to immerse the small plant in colchicine, a chemical extract from the autumn-blooming crocus, or the substance may be sprayed on leaves and buds. Another is to X-ray the seeds. A third is to heat them almost to the point of cooking, then cool them rapidly before life is destroyed. The theory is that these "shocks" reproduce the possible conditions under which nature springs mutations. For example, a hot day followed by a cold night.

At any rate the shock treatment increases the mutation percentage many fold. Hybridizers have such high hopes for outwitting nature by the method that, where the elder W. Atlee Burpee spent many months each year hunting "pick-ups" in plants, his son, David Burpee, who succeeds him, carries on seed safaris in laboratories and greenhouses where skilled scientists spend their time tricking nature into producing bigger, better flowers and vegetables for your garden.

141439

Furnace-Heat Circulator Fan Warms Cold Rooms

Hot air is drawn from the furnace and recirculated in the hard-to-heat room by a newly developed fan which is designed for attachment to the floor or wall register. Adjustable to fit any size register, it can be applied in five minutes with a screwdriver.



OWN THIS SET OF 12 FINE TOOLS

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X. F. KNURLED HANDLE
NEEDLE FILES
In a Wooden Box
That Becomes A
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Whether you're a fine die-maker in a jewelry manufacturing plant, or a home craftsman with a love of precision, these Nicholson X. F. Needle Files will suit you "to a T". What's your most delicate filing job? . . . fashioning a tiny capstan for a ship model? . . . a slide-valve for a scale locomotive? . . . in this box is the right shape Needle File to do it to perfection!

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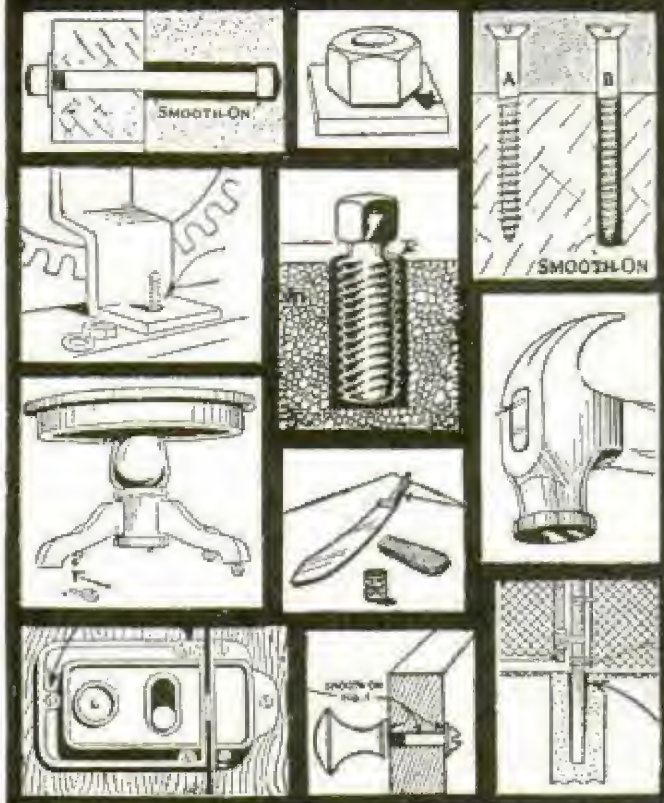
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SMOOTH-ON No. 1 restores full usefulness of household fixtures, utensils and tools that would otherwise have to be discarded.

Try it for tightening loose parts and stopping leaks of water, steam, gas, etc., at joints and cracks. Use it also on your car for stopping leaks in the radiator, hose connections, gas tank, oil and exhaust lines, for patching cracked water jackets, for tightening loose hub caps, mud guards, lamp and tire supports, etc.

Smooth-On No. 1 is simple to apply and hardens to everlasting tightness. Merely follow directions in the Smooth-On Book which is sent free if you return the coupon.

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Topsy-Turvy Weather Magicians

(Continued from page 413)

so he can study the resistance of models.

The latest machine, developed by Arthur C. Ruge of Massachusetts Institute of Technology in cooperation with Dr. Vannevar Bush, solves this difficulty in a more efficient and practical way than the old-style shaking tables. A shadowgraph—optical cam—is made from an actual earthquake record by cutting the record out along the wavy line which represents the quake. The shadowgraph then is passed before the "electric eye" of the machine. An electric analyzing device, coupled to



Small-scale reproduction of Cape Cod canal built to study effect of tidal currents

the eye, performs the function of a brain, controlling the machine in such a way that it is forced to follow the wavy line as the shadowgraph moves along.

The primary driving power of the earthquake machine is obtained from oil under pressure working against a piston connected to a platform which is free to move in any direction. The electric analyzing device controls a valve which feeds the oil into the piston chamber. This valve is moved in exactly the same way a radio receiver moves the diaphragm of a dynamic loud speaker, only the force available can reach a maximum of nearly fifty pounds and consequently can move very fast.

With the possible exception of hurricanes and tornadoes, floods are our most deadly natural enemies and, in seeking improved techniques for subduing them, engineers have turned to hydraulic laboratories. At the United States Waterways

(Continued to page 125A)

Do it with **SMOOTH-ON**

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New
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IN A FEW DAYS AT HOME!



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Each model in the "CK" KI-YAK series is convertible in 10 minutes from paddle boat to SAIL-BOT complete with rudder, tiller, leeboards, outrigger boom! The "CK" KI-YAKs are really 3 boats in one being immediately convertible into row-boat, sail-boat or motor-boat. Mead KI-YAKs are the fastest boats for their weight whether you use wind, muscles or motor **BECAUSE** Mead Ki-Yaks are:

Light as a Feather — Strong as a Giant!

Our entirely new and exclusive small-boat construction principle gives astonishing strength. Ribs can't break, rot, warp. And IMAGINE! CK-1 weighs only 20 lbs., CK-2 only 30 lbs., CK-3 only 45 lbs., CK-4 only 75 lbs., and the new 14-foot CK-5 only 75 lbs. **THAT'S PORTABILITY!** Nothing else like them! MEAD KI-YAKs are unsurpassed. This is the kind of boat you have always wanted. NOW is the time to start building one—and out all the fascinating details! Send time and coupon now for Giant-size Picture Circular, Low Introductory Factory Prices, GIFT OFFERS on Oars and Paddle!

MEAD GLIDERS

15 South Market—Dept. B-39—Chicago
MAIL COUPON NOW!

GENTLEMEN:

I enclose 10c as postage-handling charge. Please rush me your new Illustrated KI-YAK Circular, Money-Making Plan, Low Introductory Prices, and details of your \$6 Gift Paddle and Gift Oars-Offen.

NAME _____

St. & Number _____

CITY _____ State _____

RUSH ME WITH 10c TO:

MEAD GLIDERS
15 S. MARKET ST. DEPT. B-39 CHICAGO, U.S.A.



The popular Double-End Cockpit "D K-2," is a motor-boat. Takes 4 1/2 h. p. or less.



Get started on yours now!



Here's the CK-2, as a row-boat. Even sail rig too!



CK-5 with sail-rig . . . probably the fastest boat of its size ever built! Length: 14 ft. Wt.: 45 lbs.

**\$6 PADDLE
GIVEN**
with your CK
Ki-Yak—if you
hurry!

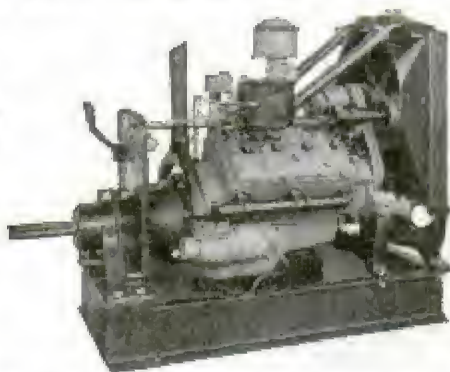
**Mail Coupon
NOW!**

Hurry—Before Prices Go Up!

The Cost of Living is going up—and MEAD KI-YAK prices may have to be raised. Send coupon now while prices are still rock-bottom. This may be your last chance to buy at present low prices! Hurry!

CAN YOU BEAT THESE POWER COSTS?

Save up to \$293.80 Per Month on power costs with a KRW FORD V8 Unit



50 H. P. with KRW V8 Unit using natural gas (1125 BTU) @ 30c per 1000 cu. ft. 546.80 per month
50 H. P. with KRW V8 Unit using gasoline @ 10c per gal. (no tax) \$140.40 per month

Above figures show primary fuel costs (lubricating oil not included) for operating a KRW V8 Unit to develop 50 H. P. for 10 hours per day—26 days per month. Compare this with electricity @ 3c per KWH which amounts to \$340.60 per month. You can pay for a KRW Unit in a few short weeks out of actual savings!

KRW V8 Units are daily saving money for operators of air conditioning and refrigeration equipment, mills, factories, shops, welders, compressors, pumps, well-drilling outfits, contractors' equipment, etc. New KRW "GUARDIAN" automatically stops engine in case of cooling or lubrication failure.

Write for new bulletin just off the press—packed with useful information, engineering data, etc. You can buy through your local Ford Dealer and benefit by local service and low-cost Ford engine replacement feature.

K. R. WILSON 17 Lock St. BUFFALO, N.Y.
Builders of Shop Equipment for Ford Dealers Since 1916
West Coast Branch: 722 Mateo St., Los Angeles.
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CATCH MORE FISH

Send for **FREE BAIT BOOK**

This practical handbook, for fishermen, is a fascinating, reliable guide to better fishing! It tells how and why Creek Chub, True-to-Nature, Lure, and Flies Catch More and Bigger Fish! Beautifully illustrated! Sent FREE upon request! **CREEK CHUB BAIT COMPANY**, Garrett, Ind.
413 Randolph St.

Thompson BEATS the World on BOATS



Better Built Lower Prices

Canoes \$64 and up

Rowboats \$42 and up

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Very fast utility model

Only Boats With Full Length Spray Rails
Keep passengers perfectly dry—even at high speeds. Catalog also shows today's five most popular models of sailboats. Two big factories. Prompt shipment.

CATALOG FREE
Write for your copy. State kind of boat in which you are interested.

THOMPSON BROS. BOAT MFG. CO. (BT)
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Connects to a battery with no tanks necessary. Plates on iron, steel, brass, copper, etc. Almost as simple as painting. Hundreds of car owners waiting for this low-cost plating. Improves appearance and value of the car. Your opportunity to make good income plating auto parts, bathroom fixtures, reflectors, mirrors, etc.

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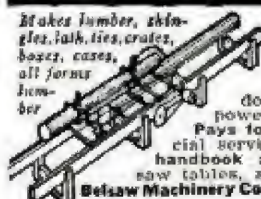
Write quick—big season here. Get **FREE PROOF** and particulars that put you in a paying business of your own.

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AVENUE M

DECATUR, ILL.

ONE-MAN SAWMILL



TURN TREES INTO MONEY WITH A BELSAW

Three capacities: 10, 14 and 20 ft. Accurate set works positive dogs. Hand or power feed. Runs on low power—Many owners use old auto engine. Pays for itself quickly—thousands in commercial service, everywhere. Write for free lumber handbook and catalog of mills, supplies, tools, saw tables, and woodworking equipment. **Belsaw Machinery Co., 3110-W Davidson Bldg., Kansas City, Mo.**

FARM MODEL \$49.00

PHOTO ENLARGEMENTS



Is Photography your hobby? Do you want a profitable easy business at home? Make **PHOTO ENLARGEMENTS** for yourself and others. Your cost 5c each and less. The Ideal Photo Enlarger is **AUTOMATIC**. No experience required. Also **COPIES** any picture. \$5.94 COMPLETE. Interesting circular **FREE**.

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See the whole photographic show, pick out what you need. Take advantage of our money-saving prices, wide selections, money-back guarantee. Mail penny postcard **NOW** for your **FREE** copy of this sensational Camera Catalog No. 72.

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Dept. 7CC9—100 Sixth Ave., New York, N. Y.

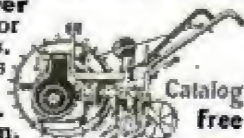
KINKADE GARDEN TRACTOR

and Power Lawnmower

A Practical Power Plow and Cultivator for Gardeners, Suburbanites, Florists, Truckers, Nurserymen, Fruit Growers

Low Prices - Easy Terms

American Farm Machine Co.
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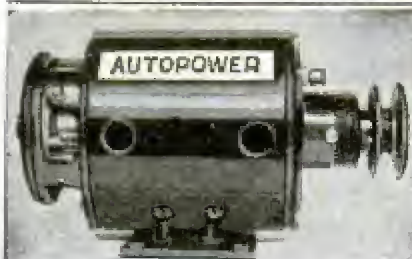
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Cards, stationery, circulars, tags, labels, advertising, etc. Save money. **Print for Others; Big Profits; easy rules sent.** Will do popular Raised Printing like Engraving. Junior outfit \$9. Senior outfit \$17 and up. Send for free catalog and all details. **KELSEY PRESSES, E-37, MERIDEN, CONN.**



CLAUSING MFG. CO. OTTUMWA, IOWA



TURN SCRAP INTO MONEY

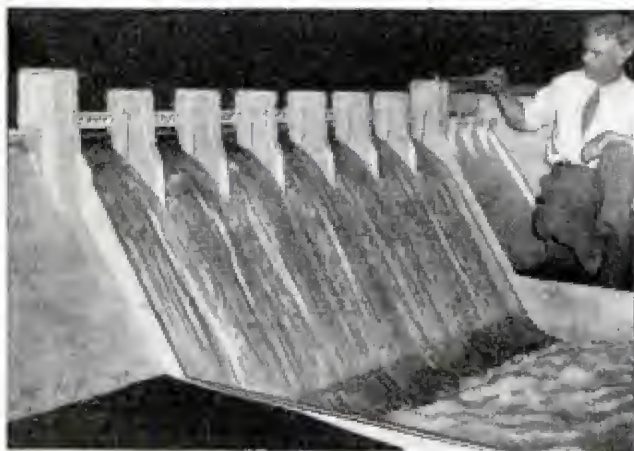
AUTOPOWER tells you how in plain, easy, simple and illustrated instructions that anyone can follow. Change auto generators into useful, practical A C and D C generators and motors with voltage from 2 to 1,000 volts, for power, light, welding, radio, sound, etc. No previous experience nor special tools needed. Generators can be driven by wind, water, fan belt, etc. **INSTRUCTIONS FOR BUILDING AND A WELDER THAT ACTUALLY WORKS UP TO A 3/16" ROD. ALSO COMPLETE PLANS FOR WIND AND WATER POWER PLANTS.** Send for your copy of "AUTOPOWER." Already used and endorsed by thousands. Only \$1.00 postpaid. **S. W. DUNCAN, Publisher.** 410 S. Hoyne Ave., Chicago



H. 1320
(Continued from page 122A)

Experiment station at Vicksburg, Miss., between 300 and 400 persons are constructing models of sections of important rivers so engineers can work out flood-control measures. On the 245-acre tract, approximately twenty-five "floods" are rampaging at once, accurately predicting surface elevations, slopes, velocities, eddies, current directions, and other factors.

Before a spade of dirt was turned on the Tygart river dam, one of a series planned to protect Pittsburgh from floods, Harold H. Thomas, head of the hydraulic staff at Carnegie Tech, and army engineers spent



Carnegie Institute engineer points to figure of six-foot man in proper scale on Tygart dam model

three years studying models of the giant faucet that is to hold back a potential of 327,500 acre-feet of water.

When details of the dam had been decided upon tentatively, the question came up as to what might happen if there were an overflow. The model indicated a hole would be gouged out below the dam wall that would weaken and possibly cause the \$18,000,000 structure to give way. The engineers turned again to the miniature and it furnished the answer—the building of a spillway apron and cushion pool.

Atlantic storms, which annually cause millions of dollars worth of damage to property and land, are created in vest-pocket sizes so experts can study the designing of protective sea walls. A plunger in a basin sends miniature storm waves breaking against an experimental sea wall, tossing spray to a height comparable in nature to more than forty feet.

No matter what the weather outside may be, the prediction for test chambers will be high winds, sleet and ice, rain, with earthquakes and floods over wide areas!

HAPPY BIRTHDAY with INDOOR "SNAPS"

(They're easy to take with G-E Photofloods)

"LOOK at my swell birthday pictures," says Molly. "And Daddy's so proud... says he's going to take lots of indoor snaps now that he's found how easy it is with G-E Photofloods."



1. "When Mummy brought in my cake I forgot all about Daddy's camera and how bright the room was. Maybe that's what makes these snapshots look so natural."

2. "I did hear several clicks as I began to blow. But after all, a cake is more serious business for a gal with a birthday."



3. "Daddy's tickled pink with this picture. And Mummy says she's so glad he thought to take indoor snapshots. I say, 'Happy Birthday'."

BIRTHDAY COMING? Take indoor "snaps" with your camera. Go to your film dealer for G-E MAZDA Photoflood lamps and new "super" type film that make it easy.



New Lower Prices
G-E MAZDA Photoflood Lamps

No. 1 (was 25c) now **20c** list

No. 2 (was 50c) now **40c** list



Action? Pets?
G-E MAZDA Photoflash Lamps

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No. 21 (Synchro-Press) **20c** list

GENERAL ELECTRIC
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*When your
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Turn it
RIGHT SIDE UP
with
Alka-Seltzer

● See how a bubbling glass of Alka-Seltzer will quickly help put you "right side up" when an upset stomach, attack of Acid Indigestion or a Headache makes you feel miserable.

● Alka-Seltzer is **DOUBLY** effective because it offers relief in **TWO** ways. Its analgesic action relieves pain and discomfort promptly and its alkalizing qualities help to neutralize any existing excess acid condition. Get a **30c** or **60c** package at any Drug Store.



DO YOU

WANT a new business profession of your own, with all the trade you can attend to? Then **become a foot correctionist**, and in a few weeks earn big income in service fees,—not medical nor chiropody—easy terms for home training, no further capital needed, no goods to buy, no agency. Established 1894. Address **Stephenson Laboratory, 1 Back Bay, Boston, Mass.**

"Hot Papa" to the Rescue

(Continued from page 357)

be a rocky gulley. They didn't hurt themselves or the plane but it was impossible to fly out again. The fliers were marooned for a day until searching planes sighted them and dropped food. Later on the salvage squad disassembled the plane and trucked it out to a field.

Occasionally the salvage truck hauls a new engine or wing out to a plane that had to make a forced landing. On one such occasion the salvage squad had to do their repair work during an intense sandstorm on the desert, one trouble they had being that tools were hidden in the drifting sand almost as soon as they were laid down. Mechanics who reached around for a wrench they dropped a moment before had a hard time finding it.

Each accident to a military plane, no matter how unimportant it seems, calls for an investigation because the army wants to know exactly what caused the trouble. Mechanical failures of any kind are rigorously inspected so that improvements can be made to new equipment.

With half a dozen or more scouting and bombing missions scheduled on a typical day, the dispatcher at March Field uses a radio airdrome control system to keep track of the scores of planes taking part. Each pilot or squadron leader calls the dispatching office by radio while he is still warming up his engine in the parking area. He reports his destination and mission and other data and receives permission to taxi out to the runway. On the runway, he again phones in and receives permission to leave the ground. Dispatching is handled very much like the dispatching at a busy commercial airport.

On his way back to the field, a returning pilot calls in while still several miles away, requesting landing instructions. He may be told to circle at 4,000 feet for five minutes while a group of twenty-eight planes ahead of him complete their landings, or he may be told that the field is clear, no traffic reported, and that he is free to land immediately. Then the dispatcher adds his final instructions to the pilot: "Get your wheels down!"

☐ Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

\$200 My First Week



... Now in
my OWN
Business.

Would you, too, like to own a business where you could take in \$200 your first week as did L. A. Eagles in Madison, Wisconsin?

We want a reputable, honest man in each locality. This man need not have any special experience or more than ordinary ability, but he must be honest and courteous.

Such a man we will start in business for himself. You can make far above average profits in the rug-washing business—a high-grade business all your own. Many earn \$125 to \$200 per week—some considerably more.

NO SHOP NECESSARY

The rug-washer finishes rugs like new on the customer's floor. Anyone can run it. Electricity does the work. A quick, thorough and highly-efficient method that restores the natural beauty of floor coverings.

There are hundreds of customers—in your vicinity and nearby towns. The business grows steadily. Simply wash a few rugs or carpets. These customers tell others and also give you their future work. Soon you will have a prosperous year-around business. Send coupon for booklet explaining everything.

"Profits Pay for Home"

Harry Hill built and paid for a home from rug-washer profits. His first day's business was \$86. Another man writes, "Made \$70 in 13 hours." A. L. Miller says, "Have had rug-washer 6 years—have earned as high as \$92 a day." M. O. Malmin earned 3 times the cost of his machine the first two months. You, too, can enjoy a large income.

VON SCHRADER MFG. CO., 103 PL., RACINE, WIS.

Free Book!
MAIL COUPON now

VON SCHRADER MFG. CO.
103 PL., Racine, Wis.

Send at once (no obligation) your free booklet illustrating rug-washer and telling how I can own my own permanent business: how I can earn large profits at prices below other methods; how I can become financially independent in a short time; and how I can pay on easy terms.

Name.....

Address.....

City.....State.....

"Never a Complaint"

C. J. White says: "\$100 business in six days—never a complaint." That is the nicest part of this business—every customer is more than satisfied. Stains and blotches disappear and vivid colorings and freshness in faded floor coverings come back.

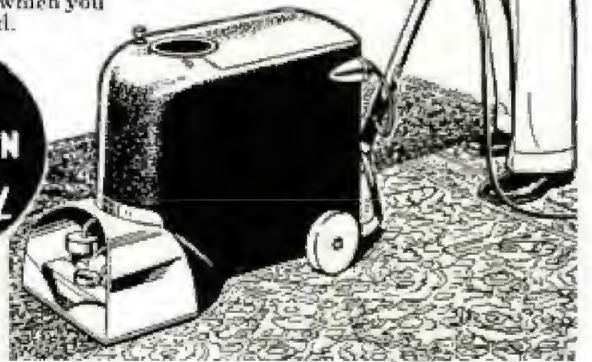
EVERY MACHINE GUARANTEED

You take no risk. These machines have been manufactured since 1918 and are used by the United States Government and by many of the world's largest hotels. They are fully GUARANTEED.

EASY TERMS

The complete equipment is inexpensive. A reasonable down payment brings everything to you and the balance is paid monthly. From the start, you have your own business—one that is profitable and of which you can be proud.

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Today



EARN MONEY MAKE COLOR GLAZED CONCRETE PRODUCTS



MAKE Color-glazed concrete pottery, tiles, walls. New method. No molds. Use only sand, cement, cheap materials. U. S. and Canada patents. Complete licensed plants low as \$35. MEN (only): Write for FREE booklet, colorplate, details of this new money-making business.

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EASY PROFITS IN PAINT SPRAYING



Paint walls, ceilings, screens, furniture, radiators, machinery faster, better! $\frac{1}{4}$ H. P. motor 110 Volt 60 Cycle AC, complete with Spray Gun, 15 ft. hose. Weighs only 44 lbs. Carry anywhere. FULLY GUARANTEED. Only \$31.15 f. o. b. Chicago. \$5 Deposit. Balance COD. or SEE YOUR DEALER. Circular FREE. Get started making money NOW!

\$31.15

Ideal Automatic Pump Co. Dept. PM-3, 801 Washington, Chicago Complete



DRIVE ANY ROUTE On the Map

You can follow any directions with a Hull Auto Compass on your windshield. Drivers everywhere depend upon it to get them there on time, and by the shortest route. It shows your direction of travel at all times, in any weather. Only \$2.95 at your dealer. Two-piece model \$1.95. Write for circular.

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HANDY TAPS and DIES...

Accurate—carefully hardened and tempered. Complete range of sizes at your local five and ten cent store

HENRY L. HANSON, WORCESTER, MASS.



FISHERMEN

GET THIS THRILLING NEW
BOOK ON FISHING Free!

"Ozark Ripley Tells About Fishing." Page after page of thrills covering all types of angling—written by Ozark Ripley, master fisherman. Also valuable information on outboard motors and boats. Write for your copy. Free! JOHNSON MOTORS, 1211 Pershing Road, Waukegan, Ill.

You're out in the Cold-



...till you get a Barbasol Face

If you think women don't notice, just shave with Barbasol for 10 days or so and see how your wife or sweetheart warms up to the improvement in your face.

Here's why:

A Barbasol Face is a smoother, younger-looking face because Barbasol does a whole lot more than give you the sweetest shave you ever had—

Its beneficial oils help to prevent razor-irritation, while you shave—and leave your skin soft and smooth and supple, after you've shaved.

Why keep on torturing your skin with old-fashioned methods that bite and burn, tending to roughen and wrinkle your skin? Why be content with other methods that leave a half-cut stubble?

Turn to Barbasol today and know the thrill of the quickest, smoothest shave in the world, plus fine protection for your skin.

Your druggist sells three sizes, large tube, 25¢; giant tube, 50¢; family jar, 75¢. Barbasol Blades, 5 for 15¢.

For Modern Shaving



No Brush • No Lather • No Rub-In

Miracle of New Color Movies

(Continued from Coloroto Section)

shining armor. The emotional stimulus was heightened here by the change from a somber to a brilliant color, and the attendant symbolism from despair to courage, hope and faith.

White-flame carbon arcs generally are used for color photography on interior sets and sunlight or sunlight with carbon arc-light mixed, for exteriors. The white-flame carbon arc light matches the color of daylight which permits the mixing of these two light sources. Illuminating engineers working with Technicolor have recently produced color-corrected incandescent lamps using special color-correcting filters so this type of equipment can be used on color photography.

High-speed camera shots, matt and painting shots, miniatures, glass shots and projection background scenes are being used more and more in Technicolor, permitting studios to save on production costs in color as they do in black and white.

Naturalness is the big aim in make-up and only a small amount is used. In fact, Ray Rennahan, color cameraman, believes many a film star could step before the color camera and work without any make-up whatever.

Experiments with color pictures began fifty years ago when Frederick E. Ives demonstrated the additive process for reproducing natural colors. He took three photographs, one through a red, one through a green and one through a blue solution. Positives were made from these negatives on lantern slides, and then they were projected, one on top of another, by three lanterns, each through its original taking solution.

Later, Charles Urban advanced the idea of substituting successive for simultaneous projection of the different colored partial pictures on the theory that the persistence of retinal impressions applies to color as well as form. His work was utilized by Albert G. Smith in a process known as Kinemacolor. He simplified operations by reducing the three primary color sensations to two, dividing the spectrum so the colors in each half corresponded to red-orange and blue-green.

In Kinemacolor, the negatives were made on a single film alternating through the red-orange and green-blue halves of a

disk rotating with the proper velocity between film and lens. A positive was made from this and projected with the aid of a similar device. The colors of the successive pictures, modified by a special fixed color screen, were combined by the persistence of retinal impressions and approximately reproduced the natural tints of a scene.

Although some excellent results were accredited to the additive methods, their chief drawbacks were that camera shutter and projecting machine had to run at twice the speed of silent black-and-white film, and there was likely to be fuzziness in the projected images.

Technicolor engineers first used an additive process. They wanted to get away from any system that called for special projection equipment so they began working with a two-component subtractive process in which two gelatin reliefs, produced on thin celluloid, were glued together, back to back, and dyed in complementary colors. The big trouble here was that the double-coated stock curled in either direction, instead of only one direction, and this upset the focus.

By 1928, Technicolor engineers devised a process which called for the transfer of the dye from a gelatin relief or matrix to a gelatin film. Color made a big splash on the screen for a year or so, then went into an eclipse until the birth of the three-component process now in use.

License Number Easier to Read When Letter Is Added

Using a letter with four or five numerals makes the automobile license plate easier to read than when figures or letters alone are used, it was found recently in tests made by Lehigh university psychologists. In a state like Pennsylvania where more than 1,000,000 cars are registered, plates can be identified with a maximum of only five digits, as Z99999. If numerals are used entirely the number would reach seven digits, which are not easily recognized or remembered.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

That's Gold

— in my
cellar - shop!

**Hundreds of
Driver - equipped
home shops
return a nice profit
as well as a lot of fun!**

It's a cinch to make money on your investment in Driver Power Tools. All around you are folks who want things made . . . who'll be glad to pay for the furniture, knick-knacks, etc., you enjoy making. Try it! The new 1939 Driver Tools will prepare you for BUSINESS . . . enable you to turn out "professional" work that SELLS. Enable you to do it so easily that your "Business" will remain FUN for you.

You'll want this NEW 14" BAND SAW—



It's as slick in operation as it is in looks. Does a multitude of jobs. Example is the corner cupboard shown above. Its keen blade travels 2535 feet per minute; zips through heavy oak as easily as a light panel. Rips, cross-cuts, makes accurate curved, angle and mitre cuts. Has a big 16"x16" tilting table and many other features. Built so well that big wood-working plants are using it. Costs little to own.

Your local Walker-Turner dealer will demonstrate this tool, also the new Driver 10" Geared Power Tilting Arbor Saw . . . the new 6" Jointer . . . new Metal-working Band Saw and others. Use the coupon to get the NEW 48-PAGE CATALOG which gives the details you want.

DRIVER *Engineered* POWER TOOLS

Walker-Turner Co., Inc.,
139 South Ave., Plainfield, N. J.

I want your new 1939 Catalog of Driver Tools, accessories and motors.

Name.....

Address.....

(Continued from page 363)

A black and white photograph showing a worker in a hard hat and light-colored uniform standing next to a large, complex industrial machine, possibly a pump or engine, in a dark, industrial setting. The worker is looking at the machine, which has various pipes, valves, and a large cylindrical component. The scene is dimly lit, with the worker's uniform and the machine's components being the primary light sources.

for loose rivets and cracks. He stays there about five minutes, at 210 degrees.

If she keeps her health for a month without a day off, the engine may roll up 15,000 miles. Then one day every month she must go to the shops for monthly inspection; cylinders and valve heads are re-

Add to the daily and monthly routine a quarterly checkup which includes the replacement of all gauges, tests of water pump and lubricator, whitewash inspection of drawbar and safety bar, valve stems and piston rods and examination of rod bushings, and to this a semi-annual inspection of air-brake equipment. Add to all this an annual program of removing, washing and hammer-testing air drums, a hydrostatic pressure test to drums, boiler and tubes, removing safety valve and dome cap, and cleaning all water columns. And still you have a general overhauling of every locomotive every two to five years, as its general health demands.

hour. Smooth, efficient, powerful, it is a symbol of might. But it is the grooming in the stables, day after day, that keeps the iron horse mighty—and mighty safe.

THE STRANGE CASE OF MR. SLAVIN...



**"No one—it seemed—
could find the answer"**



BERNARD SLAVIN
Chicago, Illinois

"Last September—three months after I had spent \$12.00 for a well known battery—I began having starting trouble! During the winter I had to be pushed at least 15 times! And each time I got madder. Battery dealers would look my battery over—test it—recharge it again . . . and in a week or so I'd be in trouble again. *No one could find the real answer!*

"Finally someone told me about *Willard Starting Service*. I went to a Willard Dealer and in a few minutes he found the cause of the trouble, *which wasn't in the battery at all!*

"He showed me why most run-down batteries are caused by little things you never see—worn or undersize cables, loose connections, faulty wiring, and voltage regulators that need adjustment. He showed me how he can locate these hidden flaws quickly with the *new Willard Electrical Check*.

"Believe me, if you want freedom from trouble—get acquainted with *Willard Starting Service*."

Ask Your Willard Dealer About It!

You should know about this new kind of *positive* protection against Starting failure. By keeping you out of trouble we hope to merit your business, and *Willard Starting Service* is our way of EARNING your patronage. Come in and try it.

Your Willard Dealer

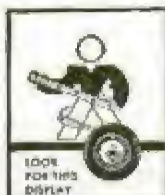
You can identify our station by this sign.



If you are interested in the "why" and "how" of the instrument that makes this service possible, send a letter or postcard to Willard Storage Battery Company, Dept. M-3, Cleveland, Ohio.



Here's the steel tape engineers prefer. It's hard to kink, hard to curl. **BLACK-ON-WHITE** means easy reading, fewer errors. Bonded white surface protects steel from rust and is easy to clean. 25, 50, 75, 100 ft. lengths. Good for a long life of tough use. Mail coupon today for free sample of tape and illustrated folder showing new, popular-priced models.



K & E FAVORITE WYTEFACE STEEL MEASURING TAPES

KEUFFEL & ESSER CO., Est. 1867, Dept. 29, Hoboken, N. J.

Name _____

Address _____

City _____ State _____

HOLD-E-ZEE

Automatic Grip Screwdrivers

Hold, start and set-up screws in unhandy places. Gripper instantly released by spring action, sliding up out of way when not in use. Finest materials throughout, chrome vanadium blades; many have transparent, insulating, unbreakable handles. Models for recessed-head screws. No more wobble than ordinary screwdrivers. At auto-supply, hardware or electrical stores.

UPSON
BROS., INC.
66 Exchange St.
Rochester, N. Y.



NEW! ALADDIN READI-CUT WORLD'S LOWEST-PRICED QUALITY HOMES!

**\$495
UP
WE PAY
FREIGHT**



BUY DIRECT—SAVE UP TO 30%

Yours! . . . a beautiful, new Aladdin home at up to \$800 saving by buying direct from our big mills NOW! Your choice of 98 designs, 4 to 10 rooms. Aladdin Read-Cut Method saves 18% material waste, 30% labor—prices include all lumber Read-Cut, siding, millwork, windows, doors, interior woodwork, flooring, roofing, hardware, nails, paints, stains, varnish—and we pay freight! **NEW CATALOG!** Packed with full-color illustrated home values (that comply with F. H. A. loan requirements). Summer Cottages \$300 up. Send 25¢ for this big new catalog No. 326 TODAY! Write nearest mill.



ALADDIN CO. BAY CITY, MICHIGAN
Portland, Ore.; Toronto, Can.

Paul Reveres of '39 Battle Frost

(Continued from page 351)

black with oil. A few belated tankers roar down the roads, bringing oil for those pots which were not filled the day before. Giant tanks, scattered throughout the groves, loom against the sky—4,000,000 gallons of oil stored against just such an hour of need. A pot burns nine hours—then there must be more oil—or else.

And slowly the columns of mercury in 10,000 thermometers begin to rise. Twenty-seven—twenty-seven and a half—twenty-eight—twenty-nine—and there it holds. Every phone in the central office is busy. The riders no longer pause to light cigarettes.

Then at last the eastern sky begins to pale, the trees begin to take shape. A bit of a breeze stirs the leaves. Then a long ray of light struggles through the murk.

Sunlight—and men drop where they are, while endless miles of flaming pots form a strange pattern among the trees.

And in the central office weary hands pull off head sets, and tired voices give the last report.

"It's all right now. The bureau says it'll be warmer tomorrow night—tell the boys to come home and sleep."

The strange organization has done its job—so that you and I can have our glass of orange juice—and a great industry can continue to live.

Eyes Indicate Length of Life of Middle-Aged Persons

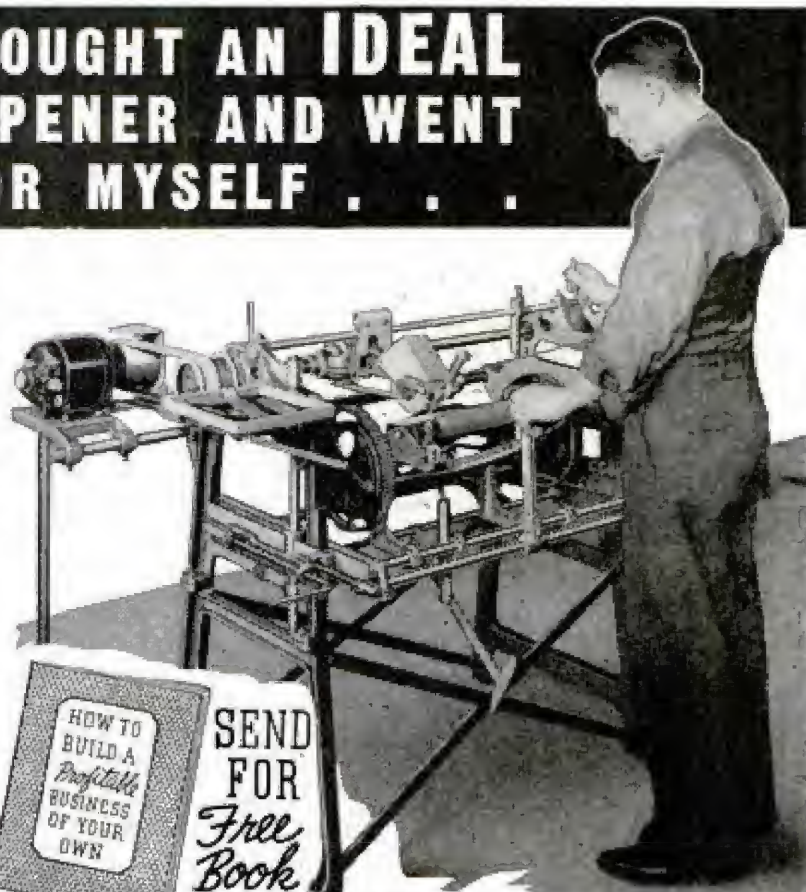
Changes in eyesight form a basis for predicting the span of life that may be left for middle-aged persons, according to studies of 8,000 cases by Prof. Felix Bernstein of New York university. The ability of the eye to change focus to see near and distant objects, called the accommodating power, is affected by hardening of the lens of the eye, which follows closely other bodily changes accompanying the ageing process. Most persons become aware of changes in their eyes at forty-five or later, and turn to glasses. If this process, known as presbyopia, takes place early in life, Prof. Bernstein says the individual will be overtaken by old age quickly, whereas a ripe old age may be expected by one unaffected by presbyopia until late in life.

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YOU, TOO, CAN HAVE A PROFITABLE BUSINESS OF YOUR OWN . . .

Our free plans show you how to build a successful business of your own sharpening lawnmowers. Most men earn up to \$25 a week, even in spare time. Howard Hellen, Minn., writes, "I sharpened 745 lawnmowers, sold 60 used mowers and grossed \$1100.00 from April 5 to Sept. 15." Roy F. Stier, Wisc., writes, "I paid for my Ideal Sharpener in exactly 36 days." Like magic, the Ideal Lawnmower Sharpener makes old, dull, badly worn mowers cut like new. Simply set the mower in the Ideal, make a few simple adjustments and the machine does the rest. Sharpens any mower to perfect edge in 15 to 20 minutes—usual charge \$1.00 to \$1.50. Attach to light socket. Start in your basement or garage. Work spare time or full time. Attachments for grinding skates, grass shears, hedge shears, sickles, scythes and axes. FREE CATALOG tells complete story.

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It's pleasant, profitable work. No experience or skill required. Easy to learn. Full line of guaranteed Stringing Tools, Frames, Gut and Silk Strings. Every item high quality. Write for complete information.

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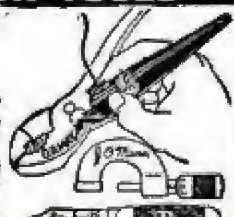
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These sensational new, improved Ranger Scooters sell like hot cakes all over the country! Order your demonstrator while territory is still open—there's big money selling to all stores needing quick, cheap delivery . . . sell to messengers, mechanics, garages, canvassers, friends; or rent for easy hourly profits at bike shops, beaches, resorts, etc. Rush post-card for illustrated circular, details. MEAD'S New Ranger Scooter for 1939 features: X-member 1-piece ALL STEEL frame, 2-speed transmission, etc. Solo models, tandem or delivery, also 3-wheel miniature car. Hurry! Write!

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WRITE for Special offer today. Rider Agents wanted.
STREIFTHAU MFG. CO., Dept. 100, Middletown, Ohio

H (43)

Making the Grade on Skis

(Continued from page 395)

"Position is very important. The arms are close to the body, the knees slightly bent, so that they are in line with the tips of your boots. For perfect balance the upper part of the body is brought slightly forward. Thus the shoulders, knees and tips of the ski boots are in perfect aline-



Clearing a ridge high in the Sawtooth mountains. Notice ski poles held ready for braking and steering

ment. Now that you are in motion, try it several times over, until you gain confidence in yourself."

Ready for a climb now? Let's have a try. The chief precaution in climbing is not to exhaust your energy too quickly. First the diagonal climb. With skis parallel, move forward up an easy slope, not straight up but on a diagonal line. Use the kick turn you have already learned when you wish to change direction. Take it easy and don't get too tired.

A half day or so at this and you are ready for the herringbone, the maneuver which takes you straight uphill. The ends of the skis are placed together and the points apart, V-shape. The weight should rest on the inside edges of both skis. The knees are still straight and apart. Move either foot about a foot forward. Then bring the other ski up, off the ground. The body is forward, weight resting slightly on the poles. Repeat the maneuver. Look backward after a while and you will see a perfect herringbone pattern in the snow.

Now you are ready for the most important and fundamental turn in skiing, the

4 14 31
snowplow turn. Start off at the top of a gentle slope as you did before. The ends of the skis are apart and the points together, the opposite of the herringbone start uphill. As you move slowly down, to turn to the right bring your left ski slightly forward. Put more weight on your left (or bottom) ski, turn your left (or outside) shoulder forward, swing your hips to the right and if you keep the same position you will find yourself making an easy, confident turn to the right. In other words, keep the snowplow position and with your body swinging, you will automatically turn. But wait a minute, beginner—don't go too fast or make a complete turn at first!

For a left snowplow, the right ski is brought forward and the weight is transferred to the right ski. Spend plenty of time on this turn. If you learn this one right, all your other turns will be right.

While learning these turns, keep up your exercises in downhill sliding and climbing. The key to skiing with skill is to practice and practice and practice. When you are well advanced you can learn the more involved turns, the stem turn, the stem Christiana, the parallel Christiana and the



Hauser shows beginners the position for a snowplow turn, the skis forming a wedge or "V"

jump turn. But it is better to know the primary maneuvers well before you graduate into such advanced skiing. Learning these first steps will keep you busy for a long time.

Our Bureau of Information keeps on file the names and addresses of makers of, and dealers in, all devices described in the pages of Popular Mechanics Magazine. We are glad to furnish this information to our readers upon request, accompanied by stamped, self-addressed envelope.

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This sensational new Black & Decker HORNET is the smallest, sturdiest 3/16" drill available today. Remarkably compact (only 6" over-all), light in weight (only 34 ounces), yet ruggedly built and highly powered. With its comfortable "Pistol Grip" and minimum spindle offset, this high-speed "vest pocket" drill permits steady, one-hand production operations in cramped quarters without fatigue.

Powerfully motored, perfectly balanced, and chockful of all the traditional quality that has made Black & Decker famous for fine tools. The 3/16" HORNET is a perfect companion to the 1/4" HOLGUN, another compact, more powerful, slower speed drill. Get full details about these two drills today. Sold by leading Jobbers. The Black & Decker Mfg. Co., 603 Pennsylvania Ave., Towson, Maryland.

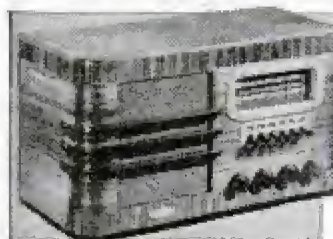
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World's Largest Manufacturer of
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SAVES
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in **RADIO!**

Send for ALLIED's free 1939 Catalog today! 180 pages of values—new Knight Radios for every requirement; Build-Your-Own Kits for beginners and advanced experimenters; P.A. systems from 8 to 65 watts; complete lines of Amateur transmitters and receivers; all leading test equipment brands; 14,000 exact duplicate and replacement parts; books, tools, etc.



Knight SETS

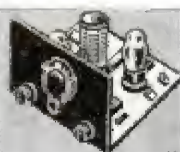
62 new models at new low prices as low as \$6.95. 4 to 16 tube sets for AC, AC-DC, 1½ Volt, 6 Volt and 32 Volt models. See the new "Tiny Knights", phonographs, phono-radio combinations, record players, all in ALLIED's 1939 Catalog!

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A new and different type of book, planned especially for radio beginners. Tells how to select circuits, read diagrams, make chassis, solder, wind coils, etc. Packed with valuable receiving and transmitting data. Send coupon with 10c for your copy.

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- ☐ Send me your Free 1939 Catalog.
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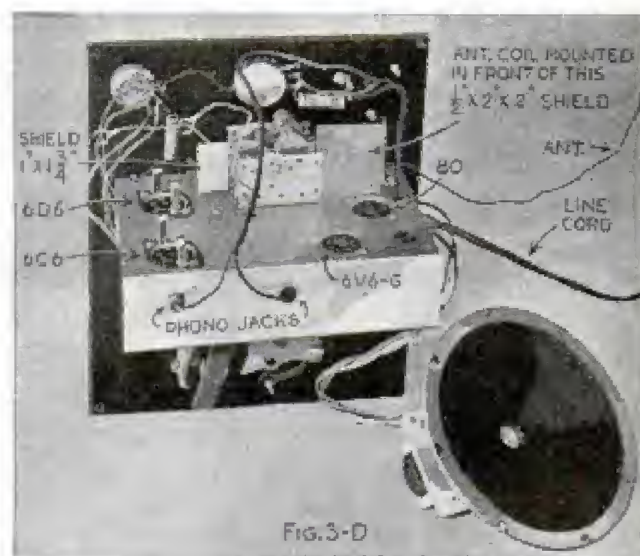
FREE
Catalog

1939 Little Giant Phono-Radio

(Continued from page 419)

Although not especially designed for beginners, this portable phono-radio unit is not difficult to build and may be adapted for installation in an old console or large table-type cabinet if the builder does not wish to use it for portable purposes. The electric phonograph feature just about doubles the cost of parts used in the construction of former models of this midget receiver.

The arrangement of the various controls is clearly given in Fig. 1; these controls, receiver chassis and phono motor are all



assembled directly on the back of the ¼-in. plywood panel which is covered with imitation leather. The magnetic pickup arm is an "Upco" type having an impedance of 10,000 ohms. This panel and the phono motor should be mounted on soft para rubber grommets and screwed loosely in position to prevent microphonic vibration. Carrying case and metal chassis base details are shown in Fig. 2; the same plywood stock and covering material are used for the case, which is provided with pull-apart hinges. The sheet-metal base is easily formed; however, it is available formed and drilled to the specifications given, if desired. A number of holes drilled in the case provide air circulation and further aid in eliminating vibration when loud volume is desired. Two 5-in. holes are cut in each end of the case, the speaker being mounted in the left end; all holes are backed with ordinary gold grille cloth.

A simplified wiring diagram of the com-

(Continued to page 138A)



JOHNSON'S NEW MIRACLE MOTOR

WORLD'S SMALLEST ALTERNATE FIRING TWIN!

Only 21½ pounds...
Underwater Exhaust
Reverse... 2.5 h. p.*

WITH SYNCHRO CONTROL,
PATENTED CO-PILOT, DUAL
INTAKE, ALROK TREATMENT
(CORROSION RESISTANT)
—12 OTHER BIG FEATURES!

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See your Johnson dealer for a demonstration. You'll find his name listed under "Outboard Motors" in your classified telephone directory.

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JOHNSON Sea-horse OUTBOARD MOTORS

With Johnson Alternate Firing, perfected through ten years of development and experience. Smoother! Better!



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BUILD THE SCHOONER BLUENOSE 22" MODEL

Complete Kit

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Smooth, steady power at your finger tips. Unmatched performance, with our own **CUSTOM BUILT** precision motor. For work on all materials. Uses 200 accessories,



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working, interchangeable in easy-working chuck to grind, drill, polish, engrave, sharpen, carve, sand, saw, rout, cut, etc. Set up shop anywhere; plug in AC or DC socket.

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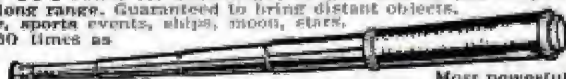
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60 POWER TELESCOPE... \$219

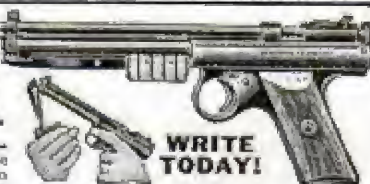
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NEW! Three telescopes in one, 3 different magnifications, 20 power for ultra-bright images with 40 and 60 power for extra long range. Guaranteed to bring distant objects, people, sports events, ships, moon, stars, etc., 60 times as close.



Most powerful made for anywhere near the money. Closest to one foot in length. Multiple lens system. 30 mm. objective lens. 5 sections. Directions included for using as a compound 4 lens microscope. American made. Prompt shipment guaranteed. We pay the postage. Only \$2.19. **BROWNSCOPE CO., Dept. 43, 5 W. 27th St., New York, N. Y.**

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Guaranteed—Accurate—Practical—Economical—Safe—Clean—Quiet. Adjustable Force—Amazing Maximum Velocity. No smoke or fumes. Soft Action—Hammer Fire—Hair Trigger—Safety Lock—Hand Pump. Single Shot BB \$8.50; Single Shot cal. 177 or 22 with rifled barrel \$8.50; BB 8-Shot \$10.00; Holster \$2.00. Also a complete line of Benjamin Genuine Compressed Air Rifles for BB and cal. 177 or 22. No license required from dealer or factory. Ask for complete specifications and Free Targets. **BENJAMIN AIR RIFLE CO., 830 Marion St., St. Louis, Mo., U.S.A.**

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Build up a business of your own stringing tennis rackets. It pays up to 140% profit per racket. String your own racket and save money. No experience necessary—we teach you how. Tennis players need new strings in their rackets two or three times yearly... every stringing means profit for you. See how simple it is to get in this business. Costs practically nothing to start. Easy work! Get started NOW!

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Makers of TOMCAT "Court-Tested" Tennis Strings & Restraining Equipment

YOU GET 'EM LIKE THIS

and DELIVER 'EM LIKE THIS

FREE Write today and we will send you **FREE** plans and special offer on strings and stringing equipment.

(Continued from page 136A)

plete combination unit appears in Fig. 3. This shows all parts above and below the base and the various controls mounted on the wood panel. Speaker-cable connections are all made direct to a terminal strip mounted on the underside of the base. Please note that the power transformer is a half-shell type; the top cover is temporarily removed and drilled for short machine screws which are used to fasten it to the underside of the metal base in the position shown. Fig. 3-A shows detailed antenna coil connections, and photos Figs. 3-B, 3-C, 3-D and 3-E give various views

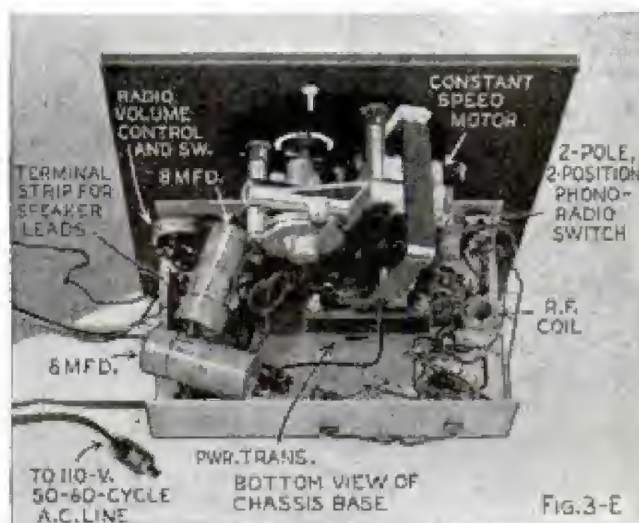


Fig. 3-E

of the completed assembly. The speaker cable should be 20 in. long to permit instrument panel removal for tube change or inspection. A schematic circuit diagram is given in Fig. 4.

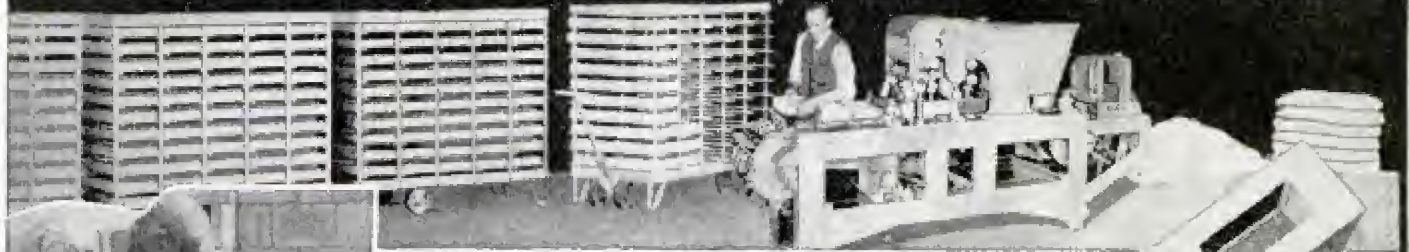
When wiring the set, the electrolytic condensers should be kept well away from the power transformer so that heat will not damage them. Also keep phono pickup leads as far as possible from the transformer and a.c. line or excessive hum will result. The shields shown in photo Fig. 3-D must be mounted between the sections of the variable condenser in the positions indicated. The dynamic speaker and its output transformer provide for a 1,000-ohm field, hum-bucking coil and 2,000-ohm impedance to match the type 6V6-G beam-power output tube. A list of the original parts used in the model can be obtained from Popular Mechanics radio department without charge.

When using the radio receiver, turn the "radio" volume control "on" and adjust

(Continued to page 141A)

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WEBB MFG. CO., Dept. P-39, 1813 Baltimore Ave.,

Kansas City, Mo.



Hunting Lost Voices

(Continued from page 379)

Vincent unearthed them, more than half a century later, from moldy cellars, cluttered attics and other places where they had lain neglected, it was necessary to handle them with the greatest of care. A single jar or a scratch on a delicate wax groove would have ruined the possibility of resurrecting the voices of such personages as the late President Wilson or Theodore Roosevelt, of Sarah Bernhardt, A. Conan Doyle, Sir Henry Irving, Admiral Robert Peary and many others.

"Re-recording these voices of long ago presented unusual and delicate problems in sound engineering," says Mr. Vincent. "There could be no second attempt on any one of them, if we were to record them on master records so that duplicates for modern phonographs could be made for official archives, for schools, colleges and historical libraries.

"The early phonograph which Mr. Edison and his men had used to record these lost voices, of course, was spring driven, and the spring did not work evenly. They were so faint in sound that it was necessary to use earphones. Besides, the speed of various wax cylinders varied. Some, for example, had one hundred grooves to the inch. Others had one hundred and fifty.

"We secured one of these early phonographs, and in the laboratory replaced its spring-driven motor with an electrical one. A delicate sapphire, which exactly fitted the grooves was cut by Frank Capps, who had been associated with Mr. Edison.

"This was one of the most important operations in the process, for, if the sapphire was not absolutely precise, the grooves would have been shaved and the voice ruined. This work, which was done under the microscope, had to be repeated tediously as wax cylinders whose grooves were of varying widths were reproduced through an amplifier to a master record on the turntable of the latest in scientific sound-recording apparatus.

"As may be imagined, hunting lost voices has a great many thrills. To hear someone speak out of the past, a human voice that has been stilled for half a century and which would be lost forever except for a fragile wax cylinder, is an experience which now may be shared by millions.

(Continued to page 144A)

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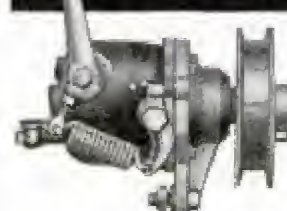
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It's America's newest musical sensation! For solos, duets, novelty effects, and for playing with piano and other instruments, it is without equal. So easy to play you can learn by yourself in just a few minutes. Music teachers endorse it as ideal pre-band instrument. **Send No Money!** Simply send name and address, and upon delivery pay postman one dollar and a few cents postage. Be the first in your group to play this keen new instrument. **TONETTE COMPANY,** Dept. PM-3, 30 East Adams Street, Chicago, Illinois.

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PER GAL.

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(Continued from page 143A)

"In this connection my greatest thrill was when I heard what few other living people had heard, the sound of the bugle which blew the call for the charge of the Light Brigade at Balaklava in 1854.

"Here was one of the crudest of wax cylinders, reinforced from the inside with twine. One whole night in 1937 my associates and myself spent in experimenting, changing sapphires and adding new equipment in order to reproduce the sound of that amazing old recording. It must have been about three o'clock in the morning when we finally heard with astounding clarity and volume the content of that record. The three of us in the laboratory felt a chill run down our spines when we heard the notes of that old bugle, which was first sounded by J. Edwards of Lord Edward Somerset's Household Troops who were fighting under Wellington against Napoleon at the Battle of Waterloo. The bugle was kept as an heirloom by the British army and was not used again until the Crimean war in which it sounded the call for the charge of the Light Brigade, famous British regiment."

In 1890 the trumpeter, an old man, was invited to re-sound the actual charge for recording on the newly invented phonograph. The record is introduced by the clear voice of a woman announcing: "Record made at Edison House, Van Cumberland Avenue, London, August the 2nd, 1890."

This is followed by the voice of the trumpeter who says: "I am Trumpeter Landfrey, one of the surviving trumpeters of the Charge of the Light Brigade at Balaklava. I am now going to sound the bugle that was sounded at Waterloo and sound the charge that was sounded at Balaklava on that very same bugle the twenty-fifth of October, 1854."

The question of who really discovered the North Pole, Peary or Cook, has been brought up many times. On a wax cylinder recently recovered by Mr. Vincent and re-recorded, Admiral Peary is heard making a speech to the Peary Arctic Club in 1909 giving facts and figures in proof that he was the real discoverer.

Present-day historians credit President Franklin D. Roosevelt with having originated the "fireside talks" but an old record preserved by Mr. Vincent proves that President Woodrow Wilson started this

custom in 1915. President Wilson had his voice recorded in the White House and the records were sent, together with a phonograph, to Indian reservations throughout the United States so that the voice of the Great White Father could be heard.

In addition to recording the voices of the great and near great so that millions may listen to them, science is now interested also in "photographing" these voices on diagrams called oscillograms. By this means the voice chart of a famous man may be compared to that of another's and the pauses, intonation and other tricks of oratory studied.

When the present Duke of Windsor renounced his throne, his memorable broadcast was not only recorded for posterity as he literally changed history, but by means of the delicate oscillograph, a dramatic chart was made of the emotion in his voice. President Roosevelt, Hitler, Mussolini and many other prominent present-day figures are also having their voices recorded and photographed by scientists so that they will not be lost to future generations.

Trapping Modern Cattle Rustlers

(Continued from page 331)

complished by checking the ownership and sales papers of cattle at all sales points and stock yards. Animals may be spirited from their home range and moved half a dozen states away, yet the brand inspectors, tracing back on the shipment, finally catch up with the rustlers. In California all packing houses and stock yards are bonded and any temptation to deal with outlaws is removed. Inspectors make the rounds of butcher shops and retail establishments all through the state, checking each side of beef for the official stamp that can be affixed only by a government inspector at a licensed slaughter house.

In spite of these precautions rustlers would still get away with some sales if it were not for the fact that stock detectives have trained themselves to recognize stolen animals at a glance.

"That may sound like a boast," Capt. Mace says, "but it's just about the truth. A good stock detective can sit on his horse alongside a runaway and tell from one look whether some of the animals were stolen,

(Continued to page 147A)

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WEIGHS ONLY 10 LBS.
RUNS 10 HRS. ON A SINGLE GALLON
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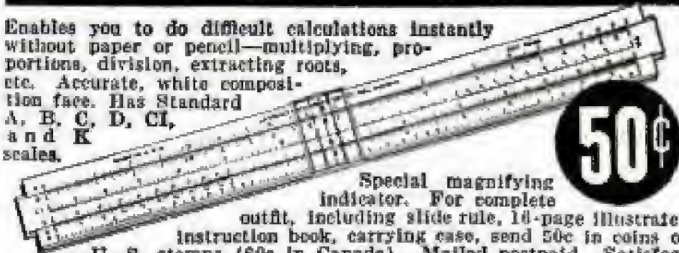
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This marvelous DYNAMIC Power Welder will do the work of much higher priced types. It is easy portable. WELDS Cylinder Blocks, Bumpers, Fenders, Tanks, Farm Machinery, and etc. Will also solder and braze on the lightest material. Works on iron, steel, tin, brass, copper and all other metals. Men without previous experience can make as much as \$4.00 on a one hour repair job. Go into business—Open a Welding Shop NOW. AGENTS—State big profits selling to garages, factories, industry and machine shops. Write TODAY for our 10-DAY TRIAL OFFER.

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\$195

RETAIL



DYNAMIC WELDER COMPANY
2226-CN Silverton Road

Chicago, Illinois

When writing please mention Popular Mechanics

(Continued from page 145A)

even if he isn't looking for stolen animals at the time.

"Not only that, without looking at the brands or the ownership papers a brand inspector can usually tell at once from what part of the country an animal came. Turn a couple of dozen cattle from all parts of the west into a corral and the inspector usually can name the home state of each animal. Half the time he will be able to name the owner, simply by the appearance of the animal. It's entirely a matter of experience and he judges an animal's home range by its appearance and quality. Even the length of the hair, depending upon the time of year, helps form his judgment."

Not long ago an inspector overseeing a movement of cattle to the chutes ordered fifteen of them turned out into a vacant corral. To an untrained eye they looked practically the same as their companions but to the practiced eye of the inspector they were vastly different. He simply noticed that the fifteen head were "feeders," cattle that hadn't yet been brought up to the prime condition that would bring the owner the best price. No owner, he knew, would normally sell cattle when he could get a much better price by fattening them for a few weeks more. The inspector was right, and it was another case of an owner having been robbed without his knowledge. Four men went to jail.

One of the queerest cases in Mace's records is the one in which some cattle rustlers were arrested on the high seas. Some of the islands off the California coast are used as cattle ranches and on one occasion some fishermen went ashore on one of the islands, shot a cow, and hauled it aboard their boat. A cowboy who heard the shot investigated and saw the fishing boat heading out to sea. From his description the boat was boarded and the slaughtered beef was found.

In some cases rustlers have increased the size of their own herds by selecting brands based on the brands of neighboring herds, imprinting their own brand over the original. In Canada the Royal Canadian Mounted Police has suggested that cattle be "nose printed" similar to the fingerprinting of humans as a positive check of their identity, since it is claimed that all noseprints of cattle differ.

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Make _____ Type _____

of Car _____ of Body _____

Model _____ Year _____

Name, Number or Series _____ of Model _____

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Cost Me _____ ☐ New or ☐ Used

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POLISHES — SHARPENS — CARVES

The new WHIZ ELECTRIC TOOL is the handiest power tool ever made. Not a delicate instrument but a real rugged tool, equally effective for both power and precision work. Drills through 1/2 inch iron plate in 42 seconds in one stroke! Intricate designs on jewelry. Handles any material! Metals—Woods—Alloys—Plastics—Glass—Steel—etc. Saves time. Eliminates labor. Plug into any socket AC or DC, 110 volts. Chuck 1/2 inch capacity. Ball bearing thrust. Powerful, triple-gear motor. "Worth its weight in Gold." **STANDARD MODEL** with Normal Speed, turns 80 different accessories, instantly interchangeable. Special Introductory Price for **FREE** accessory outfit (Value \$2) includes set of grinder, grinding disc, cutting wheel, mounted brush, polishing wheel, carving bit, etc. **FREE** with each outfit ordered NOW. We pay postage. Will send C. O. D. if desired. **10-DAY TRIAL—MONEY BACK GUARANTEE.**

Special "2-SPEED" MODEL combines Normal Speed and High Speed in one outfit turns 200 accessories! Only \$8.95 complete, with some necessary outfit (Value \$2) **FREE.**

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NEW**CORONA**
ZephyrTHE 9 lb. WONDER
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SPACER84 CHAR-
ACTER FULL
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KEYBOARDTUCKS AWAY IN
A DESK DRAWERONLY
\$29⁷⁵L. C. SMITH & CORONA
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Syracuse, N. Y.Please send free folder describing
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- Costs Only \$1.00

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2135 No. Racine Ave.
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Verti-flex antennas: \$.....
(m.o.-cash) enclosed as payment
in full.

NAME

ADDRESS

CITY

STATE

N 1524

The City of Tomorrow

(Continued from page 323)

I think there is going to be something to take the place of the poolroom—a glorified Leisure House where people may have social contact with others. Most of the objectionable forms of recreation today are merely forms of escape. The idea of haste will be removed. Today we are rushing to do something. We will temper all that with leisure, therefore nervous diseases will be



Artist's sketch of Perisphere's interior shows visitors on revolving platform, with Democracy below. This is a night view

eliminated to a large extent. We will be happier and healthier because of our surroundings.

Our satellite town will take care of elementary education, then the children will go to the hub to complete their schooling in a fine university, with museums, excellent libraries and other advantages near by.

New clothes, rather than new clothing, will be designed for the future. We will accept the human body and make every attempt to bring out its good points. The man will plug his suit into an electric-light socket, then set a meter at the temperature which will keep him comfortable all day, either hot or cool days. The suit will have properties to retain that temperature. Clothes will be far less expensive and more colorful. In the future city

(Continued to page 150A)

KILL RATS WITHOUT POISON

**YOUR
MONEY
BACK
IF RATS
DON'T
DIE**



K-R-O won't kill Livestock, Pets or Poultry; Gets Rats Every Time. K-R-O is made from *Red Squill*, a raticide recommended by U.S. Dept. Agr. (Bul. 1533). Ready-Mixed, for homes, 35¢ and \$1.00; Powder, for farms, 75¢. All Drug and Seed Stores. Damage each rat does costs you \$2.00 a year. K-R-O Co., Springfield, O.

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Comfortable, Sturdy Cape Cod Lawn Chair. Blueprint, 50¢
12 Arcadic Trellises. Blueprint all 12 only, 50¢

Special All Blueprints mentioned above for only \$2.00. Send for Illustrated Catalog.

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since cars were made, known as Knee accelerator operated inside of Knee direct to carburetor, indorsed by all Commercial Travelers Who wishes to make time with ease and Safety.

4 Orders taken on a 20 minute demonstration, send PO Money Order \$3.00 for 1 accelerator, let us know territory wanted.

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ACE
LATHE TOOL SET
\$14.50



Be permanently tooled-up for every operation on your Metal Cutting Lathe

The ACE Set is complete—there's nothing more to buy. Drop forged by the manufacturers of cutting tools used by 90 per cent of the plants and shops in industry they are correctly designed, are of special steel, are finely finished, are stronger—will last a lifetime. You can cut easier, faster and more accurately with ACE TOOLS.

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3 Turning Tools, 3 Cutting Tools, 3 Drilling Tools, 3 Boring Tools, 3 Threading Tools, 3 High Speed Steel Cutters and Blades, and 2 Wrenches in Filled Steel Case.

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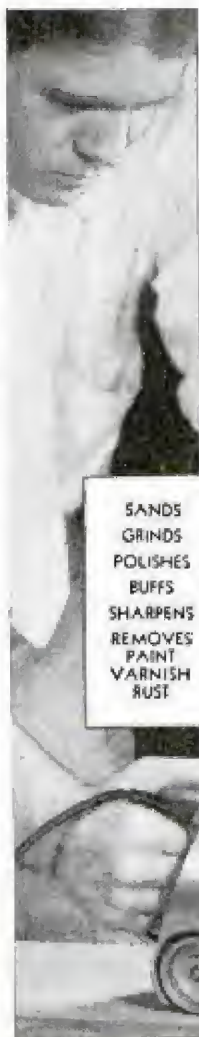
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Goodbye to
SANDING
Drudgery!

Guild Sander PORTABLE ELECTRIC

This handy portable belt sander does better work in a few minutes than you can do by hand in several tiresome hours. Driven by a powerful motor, the endless abrasive belt skims over any surface, flat or rounded, and leaves it clean and smooth. Always works with the grain—can't scratch or leave ugly, circular swirls. It works on wood, wall board, metal, slate, marble, bone and plastics. You'll discover scores of uses for Guild-Sander around the house and in the shop. Popular priced and fully guaranteed in writing. Weighs only nine pounds. Works on AC or DC. Try it at your hardware dealer's or write direct for details.

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GRINDS
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REMOVES
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"A substantial increase in grind jobs each year, proves beyond any doubt that Foley Grinders do very satisfactory work. We have ground 723 mowers since February 1 to date, November 9. Our total receipts on lawn mower service alone during that period has grossed us \$1,025.00. The prevailing price of grinding and adjusting service is \$1.00 and \$1.25—repairs and parts extra."—W. A. Tullip, Phoenix, Ariz.

You Too Can Make Big Money

Free plan tells you how to start. The Foley Lawn Mower Sharpener turns out perfect work quickly and easily, no experience needed. Simply put the mower in the machine and turn on the power. Uses same system as lawn mower factories. Sharpens all sizes and types in 15 or 20 minutes.

Special Offer: Attachment for grinding axes, hatchets, knives, etc., included **FREE** with Foley Lawn Mower Sharpener on our Special Offer, brings you business the year around. Send coupon today.

FOLEY MFG. CO. 307-9 Foley Bldg., Minneapolis, Minn.

Send Free Plan for making money sharpening lawn mowers, and Special Offer on the Foley Lawn Mower Sharpener.

Name.....

Address.....

(Continued from page 148A)

REAL TIRE ENGINEERS PRODUCE **Gillette** BICYCLE TIRES

If you should take a Gillette Bicycle Tire apart, you would find that those snappy, modern non-skid treads are extra deep and made of real live rubber. Underneath the tread, you'd find extra layers of strong, latex-dipped, cord fabric. They are built by Gillette craftsmen who developed the most important improvements in tire history—not only in bicycle tires, but in auto, truck and tractor tires. When you purchase a new bicycle or replace the tires on your present bicycle, see the Gillette dealer and examine the tire that leads the Nation in sales. The extra quality costs no more.

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2657 N. KILDARE, CHICAGO.

you need not be exposed to inclement weather, but clothes will be provided for people who want to walk in the rain because of the health-giving properties. I think that clothes will be designed as the city is designed—for the convenience of the people who live in it and they will wear clothes in which they will be comfortable, thus creating style around comfort, convenience and health.

The green belt, or parkways, of the future will be important because the green always gives off health and because it prevents people from congregating in large crowds. There won't be many tall buildings, and thus no man-made canyons where people will be forced to work by electric lights. There will be sunlight and daylight in offices. Buildings and rooms will be painted in colors which will be restful and relieve eyestrain. We will not have windowless buildings, for we want the workers to look out of the windows and rest their eyes on the greenery of the parkways. The purpose of the window will be to let in light; it will not be opened.

Our city of the future will have no traffic lights. In order to make turns there will be clover-leaf roads and all sorts of rotary traffic. Vehicles will be moving constantly—you will never have to stop. There will be no need for a horn—no tooting horn or grinding brakes. You will run no danger of being run over. Within the satellite town will be certain streets which have free-flowing traffic for the use of town people going to and from their work. Traffic from one community to another will not pass through the shopping center of our town, thus the congested streets of today will be eliminated.

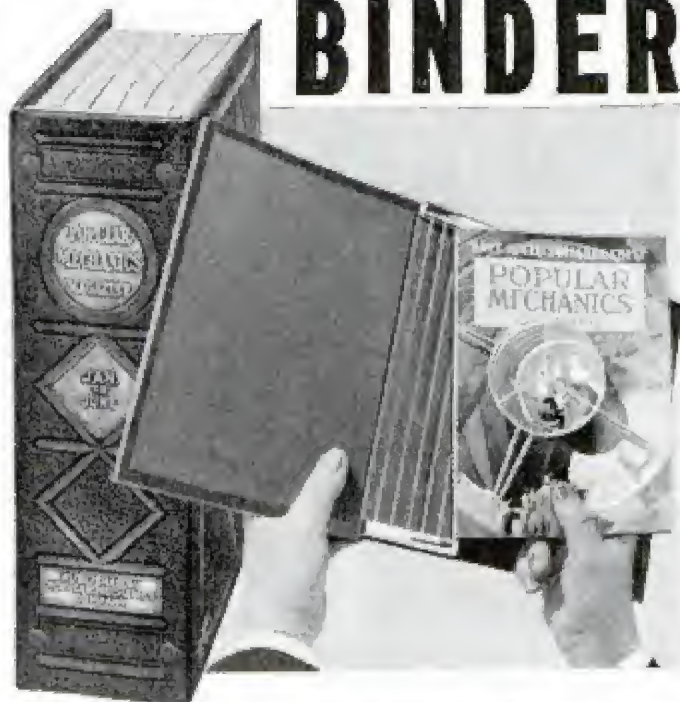
There will be only one tall building in the hub. This is a city of low buildings and our only reason for putting in a tall building is a dramatic reason—an architectural accent which points up the city. It will house the government for Democracy. It will have office space and the courts will be there.

The use of light will transform the city into another place at night. Buildings will glow with colored light and white light. Fountains will be illuminated, statues will be lighted.

Few people will live in the hub, but there

(Continued to page 153A)

NOW YOU CAN PRESERVE YOUR POPULAR MECHANICS In This Handsome PERMANENT ART BINDER



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NEPTUNES cost less but give more dependable service. Smooth trolling: plenty of power and speed when you want it. Any size YOU need, from 1.2 H.P. at \$35.50 up to 16 H.P. at \$164.50. Send for free literature.

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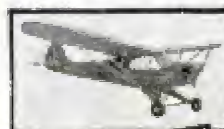
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Many exclusive special features. For instance—the new ready-carved LEADING EDGE used on the Piper Cub shown here.

PIPER CUB—latest Megow gas-powered model, sensational new light-weight. Small size that avoids cracks. Easy to build and fly. Wingspan 52 1/2". Takes any 3/4" motor. \$3.95. By mail 20c extra.



Big, handsome 50" flying outline scale models. TAYLOR CUB, AERONCA, FAIRCHILD RANGER, \$1.00. By mail 15c extra.

30" Flying models, interesting in design and detail, CESSNA 34, RYAN SC, STINSON, ARROW SPORT, AERONCA R, HOWARD DGAR, and others. 50c. By mail, 10c extra.

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Here is Harold Hunt's latest edition 1939 buyers guide and catalog. Nothing like it ever before published in the history of woodworking—136 pages of vital FACTS including new designs, new hints on finishing, many new ideas for experts (AND a new supplementary service showing beginners how to make beautiful furniture the first week) — Experts and Amateurs:

Get this book NOW

Reprinted and up-to-date. Read the latest price quotations. See the lists of all Standard American Woods, of ultra-rare foreign woods, the new style of ornaments and inlays AND note the many astounding bargain deals! — Send only 10¢ (silver or stamps) to

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2733C Mary Street Chicago, Ill.

Saw-Filing

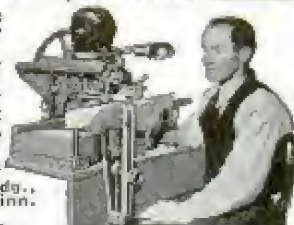
Pays up to \$2 or \$3 an Hour in Spare Time

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Send Free Plan on Saw Filing business.

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Red UNIVERSAL TRACTOR

With this practical machine and attachments you can do all field and belt work hours faster at the low cost of 33¢ per day. Many units pay for themselves the first season. Unusually easy to handle and operate. Absolutely safe. Hundreds of users. Buy direct at low factory price. Two weeks' trial—satisfaction guaranteed. Write for colorful, free catalog.

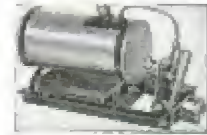
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The Simple Sensible Red-Kut way as thousands have. DIME brings PLANS and sixty picture "HOW" Book pricing many fine lines weight Westminster, tube chime, electric and battery movements showing nine beautiful colonial grandfather cases. **WHY WAIT LONGER?**

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STEAM ENGINES for small boat models. Two-cylinder power plants, ready to run, with boiler propeller and burner.

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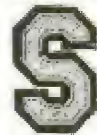


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(Continued from page 150A)

will be hotels and apartment houses along the edge of the city. Rooms will all face the green parks outside. People also will have country places on land not adaptable to farming and along the edge of the rivers. Too, there will be suburban towns that are completely residential.

Tomorrow's city will have a terminal center to which passenger traffic by air and by rail, bus and ship will come. Freight also would come to this terminal.

All highways will be illuminated to eliminate the glare of passing cars. There will be headlights on cars, but they won't be the brilliant kind. Also there will be the use of polarizing materials. Automobiles will have glass roofs so that their occupants may look out above, as well as to the sides, front and back. The traffic force in our city will be cut to a minimum. We see no great amount of crime in tomorrow's city because everybody is so happy, thus we will have a police force of only 100 men. Slums develop criminals, but we will have no slums. Instead of policemen we will have service monitors whose functions will be to assist the citizens rather than to correct them in the parking of cars. There will be only a small fire-fighting force because our city will be fireproof and because you will be able to extinguish flames by pushing a button that controls acid-shooting apparatus. The mailman will be replaced in the central city by automatic tubes which will speed a letter to the post office or to your office. The post office will be located over the transportation terminal.

All homes will be piped for sound and probably for motion-picture programs from a central station. Power will come from a generating plant located on the river near Democracy.

All these things will be possible through planning. To create the "City of Tomorrow," which is the theme exhibit at the 1939 New York World's Fair, has been a tremendous task. It has meant research into the projects of city planners. We have worked with experts in every phase of modern life, and incorporated the best features that each had to offer in this city. The result is a community which, if the funds were available, could be built tomorrow. This is no visionary city of the future; it is a practical suggestion of how we should be living today.

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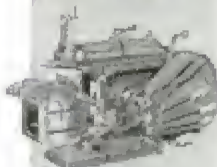
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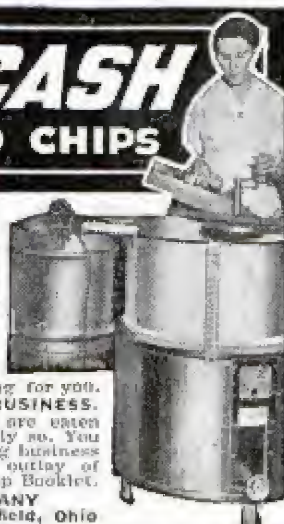
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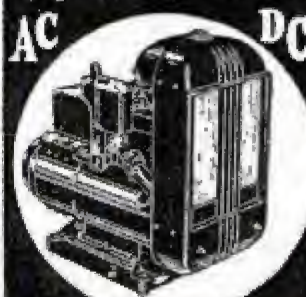
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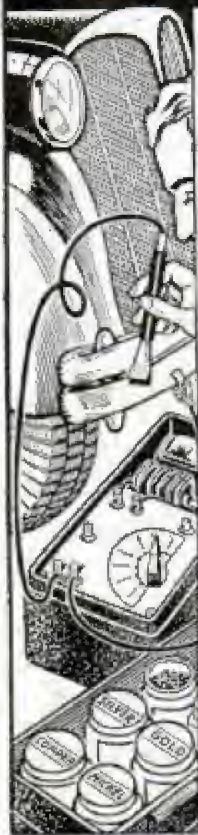
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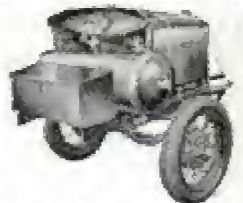
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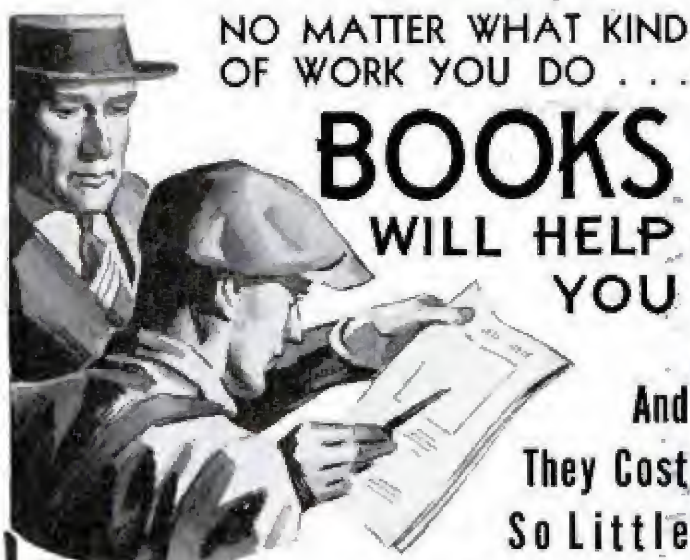
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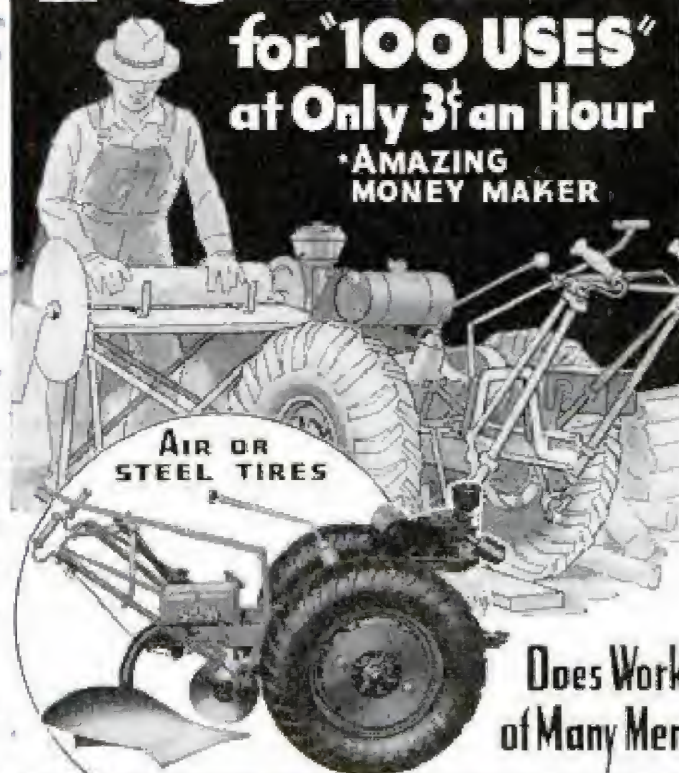
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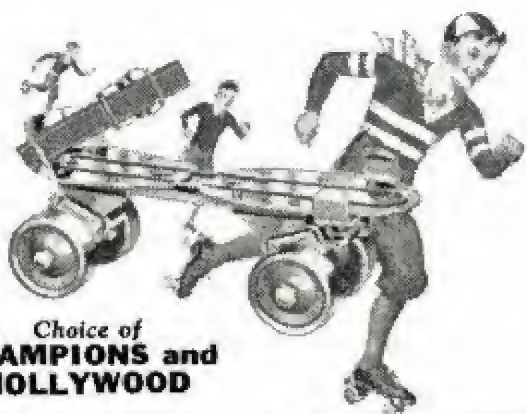


Sand-spreading trailer showing disk resting on rubber-tired wheel, and the hopper above

Sand is thrown from a spreader by its rotating disk at sufficient velocity to cover a swath forty feet wide. Men shovel sand into a hopper at the rear of a truck, from where it falls to a rotating disk equipped with six curved paddles. Riding on the pavement a rubber-tired wheel rotates the disk at high speed. The unit, mounted on the truck by two hinges, can be removed easily and hung on the tail gate when not in use, and as it lacks gears, chains or belts there are no mechanical parts that can clog.

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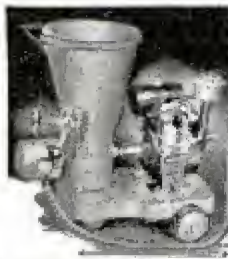
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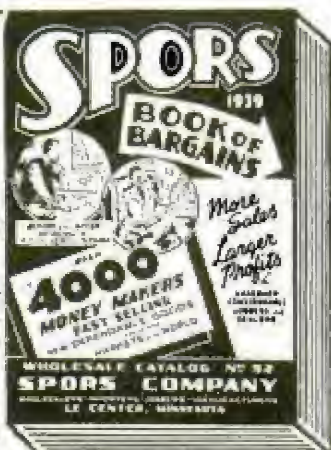
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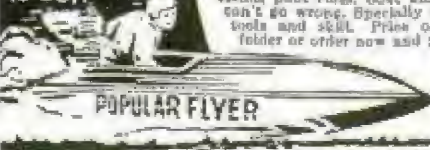
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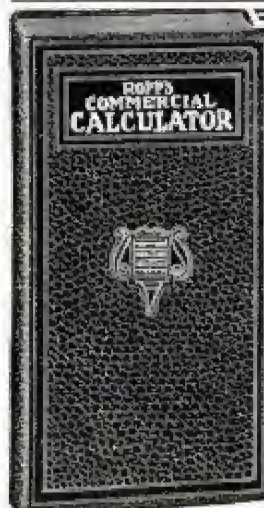
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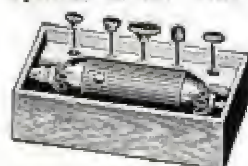
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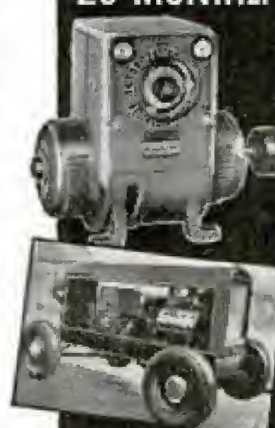
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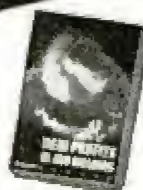
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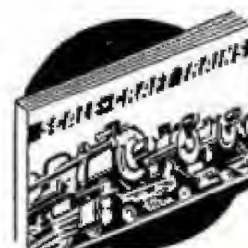
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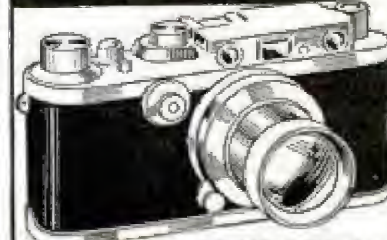


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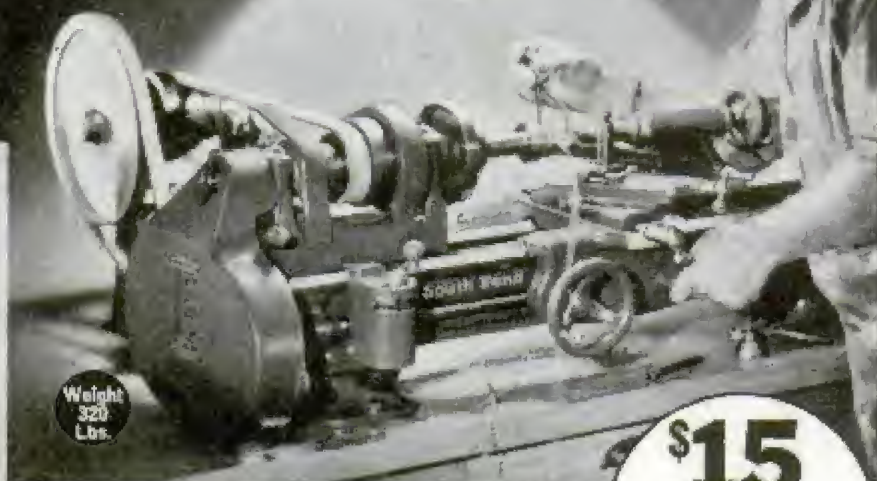
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Lbs.

No. 415-YA, 9 $\frac{1}{4}$ " swing by 3' bed Workshop Bench Lathe with Horizontal Motor Drive, $\frac{1}{4}$ H.P. Reversing Motor, Switch, Belts, Change Gears and Adjustable Belt Tension **\$117**
Countershaft.....

\$15

Down Payment
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IN YOUR SHOP**
Balance
\$6 Monthly

THIS new book shows the 9-inch precision lathe that is used by every class of industry for handling machining operations. Its important features and construction, illustrated and described in the book, are the reason for industry using this 9-inch South Bend Workshop Lathe so extensively in Manufacturing plants, Machine shops, Tool rooms, Laboratories, and Repair shops.

The 38 attachments available with the 9" lathe make it an all-purpose tool, and make any shop in which it is installed complete. Does milling, grinding, draw-in collet chuck work, taper work, and other operations.

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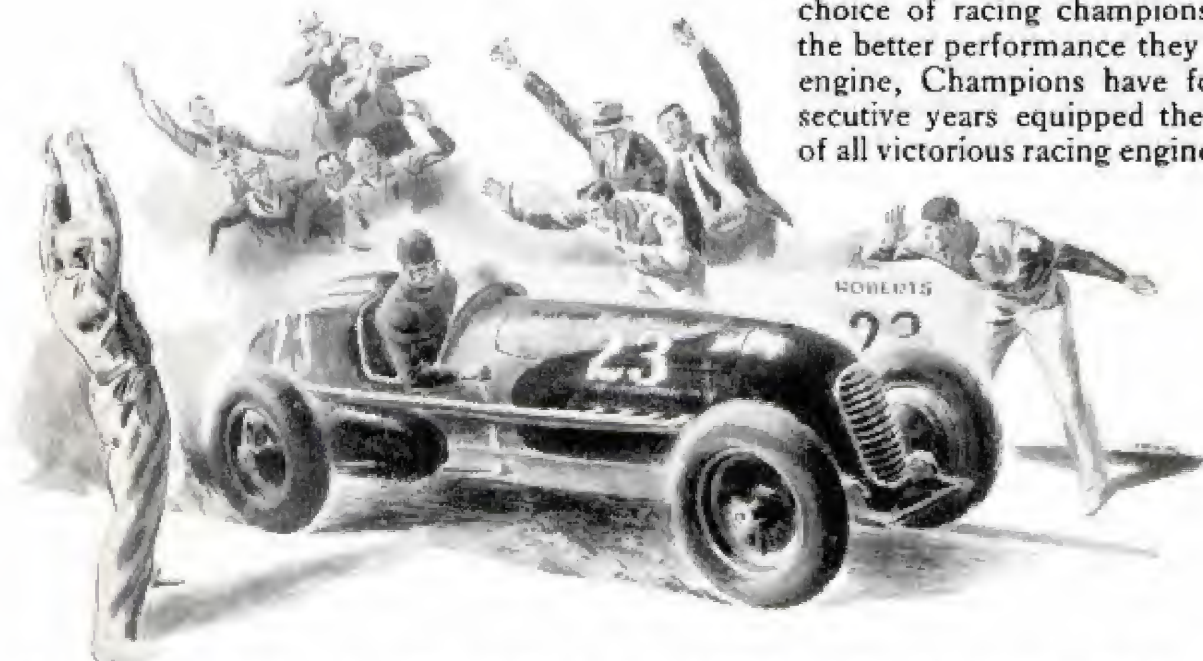
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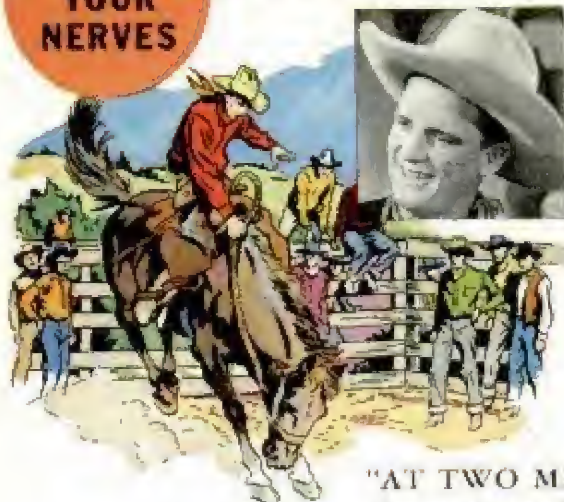
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**WATCH
YOUR
NERVES**

LET UP...LIGHT UP A CAMEL



BAREBACK RIDING TITLES fall to rodeo star Carl Dossey (*left*) because of his splendid muscular control and the fact that he keeps his mind one jump ahead of the "bronc." But that means plenty of good old-fashioned nerve strain for Carl. "It's tough, exciting work," says he, "that would soon get my nerves jittery if I didn't ease off regularly. It's a rule with me to let up—light up a Camel every time I get a chance. Camels are mighty comforting. Most cow-punchers I know go for Camels."

"AT TWO MILES A MINUTE on a dirt track anything can happen!" says Ernest Gesell, Jr. (*right*), who won a National Circuit Championship in midget auto-racing. "Skids, crashes put a big strain on my nerves." Naturally, Ernie values steady nerves. And it's a rule with him to give his nerves frequent rests—to let up—light up a Camel.



**In hazardous jobs —
in every-day "grinds"
— smokers say
"CAMELS ARE SOOTHING
TO THE NERVES"**

TWO AND ONE-HALF MILLION miles of flying without an accident! Meet Captain "Jack" Knight, United Air Lines. "I make it a firm rule to keep my nerves

from getting strained and jumpy," says Captain Knight. "Every opportunity, in the air or aground, I let up—light up a Camel. Camels are really soothing—a grand smoke!"



JOAN NELLIGAN is a proof-reader. Like so many other people in every-day occupations, she doesn't live a hazardous life, but there's plenty of nerve strain in the kind of close work she does. She concentrates intensely to keep mistakes from getting into print. Her rule for resting her nerves is this: "When I feel 'nerve fag' coming on," she says, "I let up—light up a Camel. Camels soothe my nerves. I can smoke as many as I please. Camels are so mild. They never tire my taste!"



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